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TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded April 20, 1865. Incorporated Dec. 1, 1894.

NO. 76.

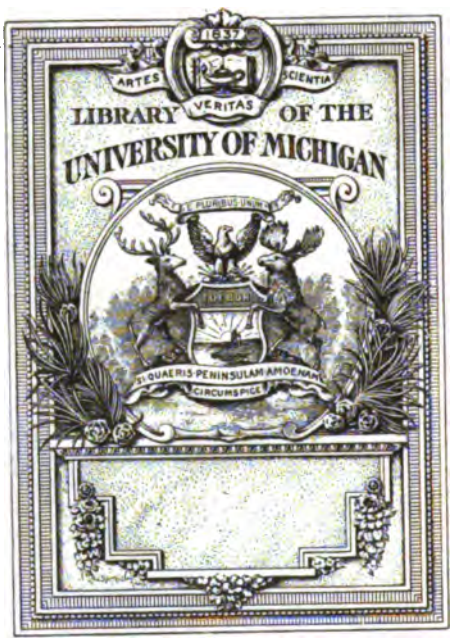
ANNUAL MEETING.

Held in Huntington Hall, Rogers' Building, Institute of Technology, Boston.

APRIL 27-28, 1904.

Office of the Association:
Room 37, International Trust Building, 45 Milk Street,
Corner of Devonshire St., Boston, Mass.

WALTHAM, MASS.:
PRESS OF S. L. BARRY.
1904



THE GIFT OF

Association.

TS
1550
. N2

NEW ENGLAND

Cotton Manufacturers' Association.

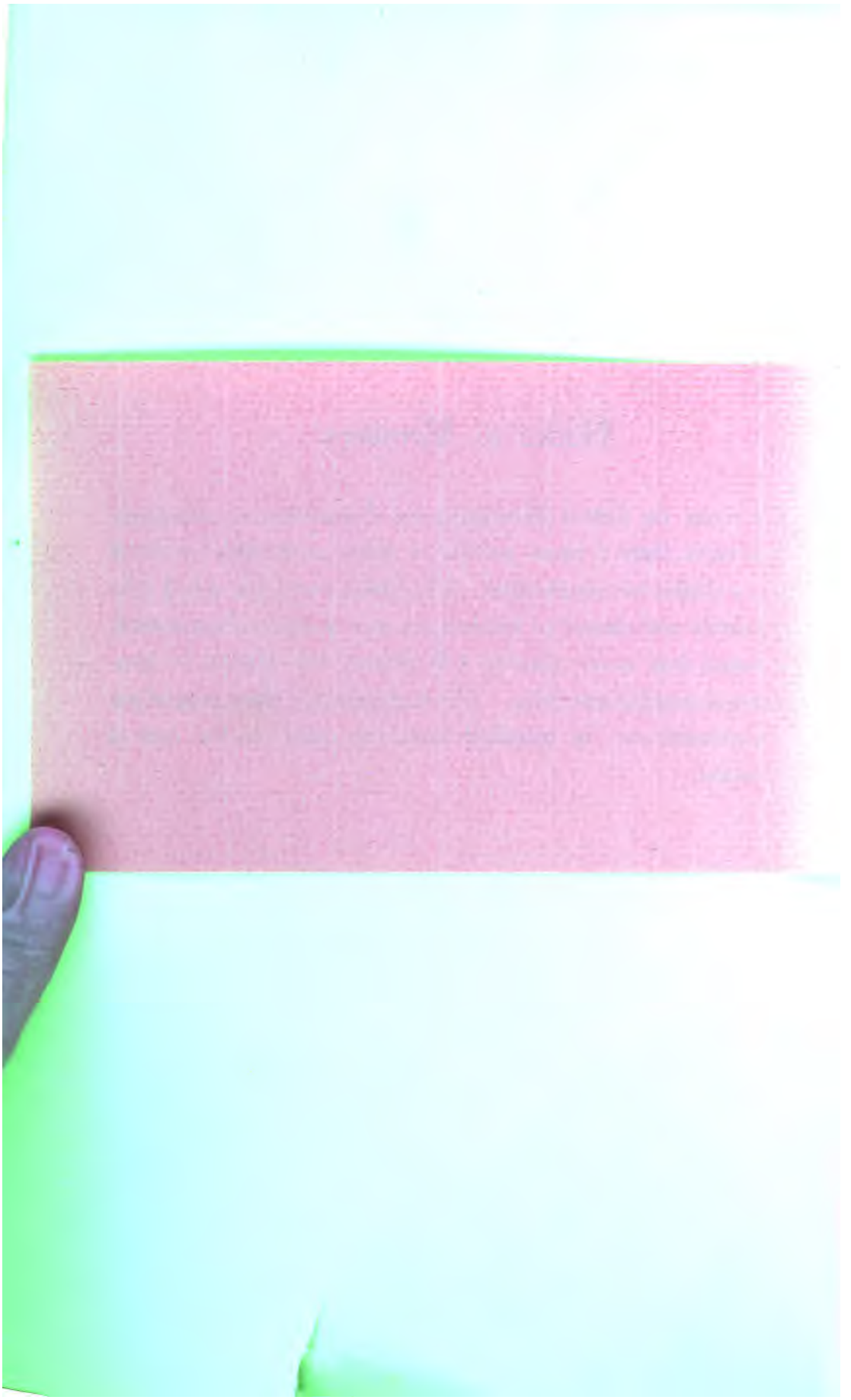
Proposal for

.....

Membership of

Notice to Members.

To make the Cotton Manufacturers' Association an absolutely representative body it must include as many as possible of those who are eligible for membership. It has been found that many who were eligible and desired to join had not done so because not invited. It is hoped that every member will present the matter to non-members among his associates. The accompanying blank proposition for membership can be detached from the cover at the row of perforations.



NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

. . . . . .

Membership of

. . . . . .

Application Received

. . . . . 190 .

Action by Board of Government, ...*favorable.*

. . . . . 190 .

Voted by the Association, ... *elected.*

. . . . . 190 .

New England Cotton Manufacturers' Associa

Room 57, International Trust Buildin

45 MILK STREET,

BOSTON, MASS.

PROPOSAL FOR MEMBERSH

(When filled out, to be mailed to the Secretary, P. O. Box 3672, Bosto Mass., in time for action by the Board of Government, at least one week befo a meeting of the Association.)

Mr. .....

Position, ...

P. O. Address, ...

is proposed for ..... *membership in the* NEW ENGLAND COTT
active or associate

MANUFACTURERS' ASSOCIATION *by* .....
signature of member proposing candidate.

a member of the Association.

Experience of Applicant, (Please state, in full, particulars of detail, giving names, dat and nature of work, as fully as convenient.)

.....

.....

.....

.....

.....

.....

.....

.....

.....

The undersigned certifies that the above statements are correct, ar agrees that, if elected to the Association, he will be governed by its rul as long as his connection with it shall continue.

Date, ...190 .

.....
signature of candidate.

C. J. N. Woodbury

National Association, [illegible]
Manufacturers

TRANSACTIONS

OF THE

New England

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Corner of Devonshire St., Boston, Mass.

WALTHAM, MASS.:
PRESS OF E. L. BARRY,
1904.

ENTERED ACCORDING TO ACT OF CONGRESS
IN THE YEAR 1904
BY THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,
IN THE OFFICE OF THE LIBRARIAN OF CONGRESS
AT WASHINGTON.

By vote of the Board of Government, the price of the *Transactions* is $5.00 per copy to non-members. The price of this issue and the one previous is $1.00 each to members, and the prices of copies previous to Volume 61, is 50 cents to members but each member is entitled to a copy as a part of the privilege of membership.

CHARTER.

No. 6091.

Commonwealth of Massachusetts.

BE IT KNOWN, That whereas, EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN have associated themselves with the intention of forming a corporation under the name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry, promoting social intercourse among its members; and establishing and maintaining a library of works on textiles in the city of Boston, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer and Directors of said corporation, duly approved by the Commissioner of Corporations, and recorded in this office.

NOW, Therefore, I, WILLIAM M. OLIN, Secretary of the Commonwealth of Massachusetts, do hereby certify that said EDWARD W THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN, their associates and successors, are legally organized and established as and are hereby made an existing corporation under the name of the

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

with the powers, rights and privileges, and subject to the limitations, duties and restrictions which by law appertain thereto.

Seal of the Commonwealth of Massachusetts.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed this first day of December, in the year of our Lord one thousand eight hundred and ninety-four.

WILLIAM M. OLIN,

Secretary of the Commonwealth.

157076

Commonwealth of Massachusetts.

(Acts of 1895, Chap. 163.)

AN ACT TO AUTHORIZE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION TO HOLD ITS MEETINGS WITHOUT THE COMMONWEALTH.

Be it enacted, etc., as follows:

SECTION 1. The New England Cotton Manufacturers' Association is hereby authorized to hold its meetings in any state or territory of the United States and in the District of Columbia; provided, however, that its annual meeting shall be held in this Commonwealth at least once in five years.

SECT. 2. This act shall take effect upon its passage. [Approved March 23, 1895.]

AMENDMENT TO CONSTITUTION AND BY-LAWS.

The following amendment was adopted at the seventy-fifth meeting of the Association, September 30, 1903:

"ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

All articles of the Constitution and By-Laws, beginning with Article 5, shall be increased in number to the next cardinal number."

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

FOUNDED APRIL 20, 1865.

INCORPORATED DECEMBER 1, 1894.

CONSTITUTION AND BY-LAWS.

ACTIVE MEMBERS.

ARTICLE 1. Any person who is actively engaged as President, Treasurer, Agent, Superintendent or Manager in the manufacture, printing or finishing of cottons shall be eligible for active membership.

ELECTION OF MEMBERS.

ARTICLE 2. All nominations for membership shall be made in writing, at least one week before the date of any regular meeting, and shall be considered by the Board of Government, and reported to the meeting, favorably or adversely, for the action of the Association. *Provided*, that in case the Board shall decide to report adversely upon any nomination, the member who shall have made it shall be informed of the intention so to report, in order that he may have an opportunity to withdraw the name. Upon such report active members may be admitted, if they obtain a majority of votes of the members present and voting therefor, by acceptance in writing, and paying an admission fee of ten dollars, and maintaining their membership by the payment of an annual assessment not exceeding ten dollars.* Any member failing to pay two successive assessments shall cease to be a member at the end of six months from the date when such second assessment shall become due. Any member may withdraw from the Association upon payment of all arrearages, first giving notice of his intention so to do, in writing, to the Secretary, and the Board of Government may accept such resignation; and any member may be expelled for cause,

* This assessment has never exceeded five dollars for active members and ten dollars for associate members.

at any regular meeting, two-thirds of the members present voting therefor.

ASSOCIATE MEMBERS.

ARTICLE 3. Persons engaged in the manufacture of cotton or cotton fabrics, or the manufacture of textile machinery, or industries kindred to the cotton manufacture, may become associate members of the Association. The methods of application, nomination, election and withdrawal from the Association being under the same conditions as those provided for active members in Article 2, excepting that this class of membership does not carry with it the previlege of voting or speaking, except by permission from the Board of Government or a vote of the Association to allow permission.

The initiation fee for associate members shall be twenty-five dollars, and the annual assessment shall be double the sum annually voted for active members.

Associate members may be expelled by a majority vote of the Board of Government.

HONORARY MEMBERS.

ARTICLE 4. Honorary members may be elected, when recommended by the Board of Government, at any regular meeting of the Association, who shall be enrolled as such, and shall be entitled to attend the meetings of the Association and participate in its proceedings, without the right to vote. They shall not be subject to payment of admission fees or assessments. No person actively engaged in cotton manufacture shall be eligible to honorary membership.

LIFE MEMBERS.

ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

ARTICLE 6. It shall be the duty of all members of the Association to make returns to the Secretary of such statistics as may be called for by him, under the direction of any committee duly appointed for the collection of statistics, when not incompatible with private interests.

OFFICERS.

ARTICLE 7. The officers of this Association shall be a President, two Vice-Presidents, six Directors, a Treasurer, Secretary, and Auditor of Accounts.

ELECTION OF OFFICERS.

ARTICLE 8. At each annual meeting there shall be chosen by ballot a President, two Vice-Presidents and two Directors; the President and Vice-Presidents to serve one year, and the two Directors shall be chosen for terms of three years.

DUTIES OF OFFICERS.

ARTICLE 9. The President, or in his absence the senior Vice-President present, shall preside at all meetings of the Association and of the Board of Government. All officers shall hold their respective offices until their successors shall be chosen and accept their positions.

ARTICLE 10. The President, Vice-Presidents and Directors shall constitute a Board of Government, and have under their care and direction all matters pertaining to the management of the Association; and five of their number shall constitute a quorum for the transaction of business. Meetings of the board may be called by the President, at such time and place as he may deem expedient, giving each member a written or printed notice of the same at least five days before the day of meeting. At their first meeting the board shall elect a Treasurer, Secretary, and Auditor of Accounts for the year ensuing, and fix the amount of compensation of the Secretary. All vacancies in their board occasioned by death or resignation shall be filled by the board; and the persons so elected shall hold their offices until the next annual meeting. The board may, from time to time, as they shall deem expedient, appoint committees, from among their own board or from the members at large, to collect statistical information, examine new inventions or processes in manufacturing goods, as also to prepare essays on subjects of interest to the Association.

ARTICLE 11. The Treasurer shall keep a book in which all receipts and payments of money shall be entered, collect all moneys due the Association, and disburse the same upon the written order of the Board of Government. At the annual meeting in each year he shall make an exhibit of his accounts, or oftener if the Board of Government require

it. He shall notify the members of assessments voted, and cause them to be collected in a reasonable time.

ARTICLE 12. The Secretary shall attend all meetings of the Association and of the Board of Government, and keep accurate records of their doings. In the absence of the Secretary at any meeting, a Secretary *pro tem.* may be appointed by the presiding officer, who shall be sworn to do all things, while in office, required of the Secretary.

ARTICLE 13. The Auditor shall examine the accounts of the Treasurer annually, and report at each meeting the state of the finances.

MEETINGS.

ARTICLE 14. The annual meeting of the members of the Association shall be held on the last Wednesday of April, or at such other time, and at such hour and place as the Board of Government may appoint. There shall also be a semi-annual meeting of the Association on the last Wednesday of October, in each and every year, or at such other time, and at such place and hour as the Board of Government may appoint.

Special meetings may be called by the Board of Government whenever they deem it expedient, or upon the written application of any ten members, made to the Secretary.

ARTICLE 15. All meetings of the members of the Association shall be in pursuance of a written or printed notice, addressed to each member, with the name of the President or Secretary attached thereto, and deposited in the Post Office ten days at least before the day of meeting, specifying the time and place of meeting; and at all such meetings fifteen members shall constitute a quorum for the transaction of business.

ARTICLE 16. Amendments to the By-Laws may be made at any stated meeting of the Association by a two-thirds vote; *provided*, notice of such proposed amendment be given in writing at a previous meeting, and also notice be given to each member by the Secretary, of the pendency of such amendment, ten days at least before any such meeting.

BOARD OF GOVERNMENT.

1904.

PRESIDENT.

HERBERT E. WALMSLEY, . . . NEW BEDFORD, MASS.

VICE-PRESIDENTS.

WILLIAM D. HARTSHORNE, . . LAWRENCE, MASS.
JAMES R. MacCOLL, ... PAWTUCKET, R. I.

DIRECTORS.

GEORGE A. AYER, ... EASTHAMPTION, MASS.
CHRISTOPHER P. BROOKS, . . NEW BEDFORD, MASS.
GEORGE P. GRANT, JR., . . . FITCHBURG, MASS.
PHILIP A. MATHEWSON, . . . FALL RIVER, MASS.
J. R. MONTGOMERY, ... WINDSOR LOCKS, CONN
WILLIAM D. PENNELL, ... LEWISTON, ME.

AUDITOR.

C. E. ROBERTS, ... BOSTON, MASS.

SECRETARY AND TREASURER.

C. J. H. WOODBURY, P. O. Box 3672, BOSTON, MASS.

OFFICE OF THE ASSOCIATION:

ROOM 57, INTERNATIONAL TRUST BUILDING, 45 MILK STREET, CORNER OF DEVONSHIRE STREET, BOSTON, MASS.

OFFICERS OF THE ASSOCIATION,

FROM THE FIRST ORGANIZATION.

PRESIDENTS.

Ezekiel A. Straw,	1865–78	Edw. W. Thomas,	1894–95
Amos D. Lockwood,	1878–80	A. M. Goodale,	1895–96
John Kilburn,	1880–83	Arthur H. Lowe,	1896–97
William C. Lovering,	1883–85	Russell W. Eaton,	1897–98
Richard Garsed,	1885–86	Stephen A. Knight,	1898–99
J. S. Ludlam,	1886–88	Frederick E. Clarke,	1899–99
Henry F. Lippitt,	1888–89	D. M. Thompson,	1900–01
Walter E. Parker,	1889–92	Charles H. Fish,	1901–03
Robert McArthur,	1892–94	H. E. Walmsley,	1903–

VICE-PRESIDENTS.

Amos D. Lockwood,	1865–77	Simeon B. Chase,	1891–93
William A. Burke,	1865–73	E. W. Thomas,	1892–94
John C. Palfrey,	1873–76	A. M. Goodale,	1893–95
Edward Atkinson,	1876–78	William J. Kent,	1894–97
A. G. Cumnock,	1877–80	Fred. C. McDuffie,	1895–00
Charles Nourse,	1878–81	Henry T. Whitin,	1897–00
William F. Goulding,	1880–83	C. H. Richardson,	1900–01
Richard Garsed,	1881–85	George H. Hills,	1900–02
J. S. Ludlam,	1883–86	H. E. Walmsley,	1901–03
Walter E. Parker,	1885–89	Alfred E. Adams,	1902–03
Richard B. Borden,	1886–88	James R. MacCall,	1903–
Arnold B. Sanford,	1888–91	W. D. Hartshorne,	1903–
Robert McArthur,	1889–92		

DIRECTORS.

J. S. Davis,	1865–69	E. W. Thomas,	1888–92
Charles Nourse,	1865–78	William W. Whitin,	1888–93
Phineas Adams,	1865–74	Robert R. Smith,	1889–92
William P. Haines,	1865–69	Alfred M. Goodale,	1890–93
Thomas J. Borden,	1865–78	William J. Kent,	1891–94
Daniel D. Crombie,	1865–68	Herman F. Straw,	1891–93
A. M. Wade,	1868–69	Fred C. McDuffie,	1892–95
D. J. Johnston,	1869–70	George W. Bean,	1892–95
F. E. Clarke,	1869–75	F. M. Messenger,	1893–95
A. G. Cumnock,	1869–77	Albert F. Knight,	1893–99
Cyrus I. Barker,	1875–80	Arthur H. Lowe,	1894–96
Hervey Kent,	1877–81	Henry T. Whitin,	1894–97
David J. Johnston,	1878–82	Herbert L. Pratt,	1895–98
Walter Paine, 3d,	1878–80	Stephen A. Knight,	1895–98
Chas. L. Lovering,	1878–83	John Eccles,	1895–99
Richard Garsed,	1880–81	Russell W. Eaton,	1896–97
William H. Jennings,	1880–83	C. H. Richardson,	1897–00
Chas. D. McDuffie,	1881–83	George H. Hills,	1897–00
Walter E. Parker,	1881–85	John T. Meats,	1898–01
John W. Danielson,	1881–85	Alfred E. Adams,	1899–02
William E. Barrows,	1882–83	A. Tenny White,	1899–02
Rufus A. Maxfield,	1883–86	Charles H. Fish,	1900–01
George W. Weeks,	1883–86	Herbert E. Walmsley,	1900–01
Henry S. Howe,	1883–87	Wm. D. Hartshorne,	1901–03
Richard B. Borden,	1883–86	James R. MacColl,	1901–03
O. S. Brown,	1885–91	Geo. F. Whitten,	1898–04
Henry F. Lippitt,	1885–88	W. B. Smith Whaley,	1901–04
Wilbur A. Stiles,	1886–88	J. R. Montgomery,	1902–
Robert McArthur,	1886–89	Wm. D. Pennell,	1902–
Stephen N. Bourne,	1886–91	G. P. Grant, Jr.,	1903–
John Kilburn,	1870–80	P. A. Mathewson,	1903–
William P. Haines,	1874–78	George A. Ayer,	1904–
S. S. Spencer,	1887–90	Christopher P. Brooks,	1904–

AUDITORS.

Benjamin Saunders, .	1865–71	J. Herbert Sawyer, .	1882–00
John C. Palfrey, .	1871–73	C. E. Roberts, . .	1900–
Henry D. Sullivan, .	1873–82		

SECRETARY AND TREASURER.

Ambrose Eastman, .	1865–94	C. J. H. Woodbury, .	1894

MEMBERS OF THE ASSOCIATION.

May 1, 1904.

Members of the Association are respectfully requested to scrutinize the following list, and advise the Secretary, P. O. Box 3672, Boston, Mass., of change in address, or any error in regard to their names.

As a number of members rejoined the Association after severing their first membership, the date of their earliest election is given.

HONORARY MEMBERS.

George Arms	Grand Hotel	New York City	Oct. 16, 1872.
Henry Smith Pritchett, LL.D.,	Pres. Mass. Institute of Technology,	Boston, Mass.	Sept. 26, 1901.
Samuel Webber	Hydraulic Engineer	Charlestown, N. H.	Apr. 20, 1865.

LIFE MEMBERS.

Charles H. Fish,	Agt. Cocheco Manufg. Co.,	Dover, N. H.,	Apr. 27, 1887.
Robert W. Neff,	Chemical Mfr.,	22 India Sq,, Boston, Mass.,	Apr. 24, 1902.
C. J. H. Woodbury,	Secretary and Treasurer,	51 Baltimore St., Lynn, Mass.,	Oct. 29, 1879.

ACTIVE MEMBERS.

Alfred E. Adams	Agt. Whitinsville Cotton Mills Agt. Linwood Mills	Whitinsville, Mass.	Apr. 27, 1887.
John S. Adams, Jr.	Supt. Adams Bros. Mfg. Co.	120 Commercial St., Adams, Mass.	Apr. 29, 1896.
William P. Adams,	Supt. Pittsfield Mills,	Pittsfield, N. H.,	Apr. 28, 1904.
James W. Ahmuty,	Supt. Atlantic Cotton Mills,	Lawrence, Mass.,	Apr. 28, 1904.
Joseph D. Aiken	Asst. Supt. Ponemah Mills	Taftville, Conn.	Oct. 28, 1891.
F. S. Akin	Supt. Cornell Mills	Fall River, Mass.	Sept. 27, 1894.
Charles T. Aldrich	Treas. Aldrich Mfg. Co.	37 Weybosset St., Box 34, Providence, R. I.	Apr. 28, 1886.

George E. Ames . . . Mech. Supt. Lawrence Mfg. Co. . . Lowell, Mass. . . . Apr. 24, 1895
William Ames . . . . Treas. Fletcher Manufg. Co., Box 83, ... 47 Charles St., Providence, R. I. . Apr. 30, 1879.
Charles B. Amory . . . Treas. Hamilton Manufg. Co. . . . . 70 Kilby St., Boston, Mass. . . . Apr. 25, 1894.
Frederic Amory . . . Treas. Nashua Mfg. Co. and Jackson Mfg. Co. . . . . Room 51, Simmons B'l'd., 40 Water St., Boston, Mass. . . . Apr. 27, 1899.
Thomas Armstrong . . Supt. No. Pownal Mfg. Co. . . . . No. Pownal, Vt. . . Oct. 28, 1897
Abel T. Atherton . . . Machine Maker . . . . . Longmeadow, R. I. . Oct. 16, 1872.
William F. Arthur . . Supt. Nashua Mfg. Co. . . . . Nashua, N. H. . . . Apr. 23, 1903.
Edward Atkinson . . . Prest. Boston Mfrs. Mu. Fire Ins. Co. . . . . 31 Milk St., Boston, Mass. . . . Apr. 19, 1871.
E. W. Atkinson . . . . Stoddard, Haserick, Richards & Co. . . . . 152 Congress St., Boston, Mass. . . . Oct. 27, 1886.
H. C. Atwood . . . . Treas. Williamsville Manufg. Co. . . Killingly, Conn. . . Apr. 29, 1885.
James A. Atwood . . . Agt. Wauregan Co. and Quinebaug Co. . . . . Wauregan, Conn. . . Oct. 28, 1891.
John Walter Atwood . Supt. Wauregan Co. . . . . Wauregan, Conn. . . Oct. 25, 1895.
W. E. Atwood . . . . Pres. Williamsville Manufg. Co. . . Killingly, Conn. . . . Sept. 27, 1894.
George A. Ayer . . . Supt. West Boylston Co. . . . . Easthampton, Mass. . Apr. 24, 1895.
Nathaniel F. Ayer . . . . . 10 P. O. Square, Boston, Mass. . . . . Apr. 25, 1901.

G. H. T. Babbitt . . . Buyer Chicopee Mfg. Co. . . . . 340 Grove St., Chicopee Falls, Mass. Oct. 2, 1902.
J. W. Bailey . . . . . Principal, The Bradford Durfee Textile School . . . . Fall River, Mass. . . Apr. 23, 1903.
Dickerson G. Baker . . Mech. Eng., American Thread Co. . . . . P. O. Box B, Willimantic. Conn. . Oct. 18, 1900.
Edwin H. Baker . . . Bliss, Fabyan & Co., Box 2899 . . . . . 117 Duane St., New York, N. Y. Apr. 24, 1878.
Edward R. Ballou . . . Treas. Ballou Yarn Co., ... 189 Charles St., Providence, R. I. . . Apr. 25, 1894.
Frederick D. Ballou . . Supt. W. A. Slater Mills . . . . . Jewett City, Conn. . Apr. 23, 1903.
William P. Bancroft . . Vice-Pres. Joseph Bancroft & Sons Co. . . . . Wilmington, Del. . . Oct. 31, 1883.
Louis B. Barker . . . Agt. United States Cotton Co. . . . Central Falls, R. I. . Apr. 27, 1899.
V. T. Barber . . . . . Supt. Slater Cotton Co. . . . . Pawtucket, R. I. . . Oct. 2, 1902.
J. E. Barbour, ... Pres. Barbour Flax Spinning Co., . Paterson, N. J. . . . Apr. 28, 1904.
Lewis E. Barnes . . . Agt. Pemberton Co. & Methuen Co., Methuen, Mass. . . . Oct. 25, 1895.
William A. Barrell . . Agt. Lawrence Duck Co. . . . . Lawrence, Mass. . . Apr. 30, 1884.
Thomas Barrett, Jr. . . Pres. Langley & Aiken Mills . . . Augusta, Ga. . . . . Apr. 26, 1900.
Edwin N. Bartlett . . . Supt. Sigourney and Rockdale Mills, North Oxford, Mass. . Apr. 29, 1891.
Daniel Moore Bates . Asst. Supt. Joseph Bancroft & Sons Co., ... Rockford, Wilmington, Del. . . Apr. 27, 1898.
Joseph P. Battles . . . Sec'y Joseph Battles Co., ... Lawrence, Mass., . . Oct. 25, 1895.
Edward C. Beach . . Supt. Gate City Cotton Mills . . . East Point, Georgia . Oct. 5, 1899.

C. Enos Bean	Agt. Lawrenceville Mfg. Co.	Lawrenceville, Ga.	Apr. 24, 1902.
George W. Bean	Agt. Androscoggin Mills	Lewiston, Me.	Apr. 17, 1872.
Robert Beatty	Robert Beatty & Co. Coral and Adams Sts.,	Philadelphia, Pa.	Oct. 28, 1897.
Truman Beckwith	Treas. Dyerville Manufg. Co. 610 Manton Ave.,	Providence, R. I.	Apr. 27, 1892.
John W. Bell	Asst. Treas. and Gen. Mgr. Smith & Dove Manufg. Co.	Andover Mass.	Oct. 28, 1897.
Albert Farwell Bemis	Pres. Jackson Fibre Co., (Jackson, Tenn.) P. O. Box 5173, 89 State St.,	Boston, Mass.	Apr. 23. 1903.
A. C. Bent	Agt. Safety Seamless Pocket Co.	Taunton, Mass.	Oct. 28, 1897.
William H. Bilbrough	Mgr. and Treas. Elmira Knitting Mills and Mgr. Conewawah Spinning Co.,	Elmira, N. Y.	Apr. 24, 1902.
W. N. Blackstone	Treas. Attawaugan Co. Treas Totokett Mills Co	Norwich, Conn.	Apr. 29, 1896.
Wm. Washington Blades,	Gen. Supt. Lorraine Mfg. Co. 135 Mineral Spring Ave.,	Pawtucket, R. I.	Oct. 25, 1893.
T. Ashby Blythe	Proprietor Ashby Cotton Mills 114 Chestnut St.,	Philadelphia, Pa.	Oct. 28, 1897.
John P. Bodge	Treas. Arkwright Mills	Fall River, Mass.	Oct. 28, 1897.
Jefferson Borden, Jr.	Supt. Fall River Bleachery Co.	Fall River, Mass.	Apr. 21, 1899.
Nathaniel B. Borden	Treas. Barnard Manufg. Co.	Fall River, Mass.	Oct. 15, 1873.
Richard B. Borden	Treas. Richard Borden Mfg. Co. Treas. Troy C. & W. Mfg. Co.	Fall River, Mass.	July 19, 1865.
E. S. Boss	Agt. American Thread Co.	Willimantic, Conn.	Oct. 29, 1879.
A. E. Bosworth	Supt. Bernon Mills	Georgiaville, R. I.	Oct. 2, 1902.
Henry Deane Bourne	Treas. Hooksett Mfg. Co., 1741 Elm St.	Manchester, N. H.	Oct. 18, 1900.
Stephen N. Bourne	Agt. Dundee Mills	1741 Elm St., Manchester, N. H.	Oct. 21, 1868.
Frank A. Bowen	Supt. Appleton Co.	Lowell, Mass.	Apr. 28, 1897.
Arthur F. Brackett	Supt. Royal Arctic & Valley Queen Mills,	Riverpoint, R. I.	Oct. 25, 1895.
Albert W. Brainerd		Box 33, Lawrence, Mass.	Apr. 27, 1898.
S. Parker Bremer	Treas. Monadnock Mills 4 Winthrop Sq.,	Boston, Mass.,	Oct. 2, 1902.
Ernest Bridge	Supt. Jas. Chadwick & Bro. Ltd.	Jersey City, N. J.	Apr. 24, 1895.
George T. Briggs,	Pres. and Gen. Mgr. The Briggs Mfg. Co.	Voluntown, Conn.,	Apr. 24, 1902.
Jas. T. Broadbent,	Instr. Carding and Spinning, Bradford Durfee Textile School,	Fall River, Mass.,	April 28, 1904.
Christopher P. Brooks	Prin. Textile Dept., International Correspondence School	New Bedford, Mass.	Apr. 28, 1897.
Henry R. Brown	Supt. Phenix Mill	Box 56, Phenix, R. I.	Apr. 28, 1897.
Isaac A. Brown	Treas. Narragansett Mills	Box 324, Fall River, Mass.	Sept. 29, 1898.
James W. Brown		P. O. Box 312, Ipswich, Mass.	Oct. 15, 1873.
Thomas J. Brown	George Brown's Sons	Mt. Joy, Penn.	Oct. 28, 1897.
E. C. Bucklin	Treas. Interlaken Mills Butler's Exchange, Box 289,	Providence, R. I.	Apr. 25, 1883.

Harris H. Bucklin . . Asst. Treas. Interlaken Mills . . . Providence, R. I. . . Apr. 23, 1903.
E. R. Bullock, ... Mech. Eng., J. & P. Coats, Ltd., . . Pawtucket, R. I. . . Apr. 28, 1904.
Robert Burgess . . . . Treas. Slater Cotton Co. . . . . 128 Walcott St., Pawtucket, R. I. . . Apr. 27, 1892.
Edward N. Burke . . . Lowell Machine Shop . . . . . 216 Nesmith St., Lowell, Mass. . . . Apr. 28, 1880.
Alfred H. Burnham . . Mgr. Glasgow Mills, Station Kensington . . . . . Huntington and Jasper Sts., Philadelphia, Pa. . . Apr. 26, 1900.
Hervey Burnham . . . Supt. Beaver Mills and Eclipse Mill . . . . . 234 East Main St., North Adams, Mass. . Apr. 27, 1899.
W. R. Burnham . . . . . Norwich, Conn. . . . Apr. 29, 1885.
John L. Burton . . . . . 1042 Plymouth avenue, Fall River, Mass. . Apr. 23, 1903.

William H. Cadwell . . Agt. Jackson Company . . . . . Nashua, N. H. . . . Apr. 26, 1900.
John P. Campbell . . . Supt. New York Mills, New York Mills, Oneida Co., N. Y., Sept. 22, 1896.
Byron F. Card . . . . Mgr. . . . . Charlotte Machine Co., Charlotte, N. C. . . Apr. 25, 1888.
Horace P. Carter, . . . Agt. Edwards Mfg. Co., ... Augusta, Maine, . . Apr. 28, 1904.
Samuel A. Carter . . . Pres. Gate City Cotton Mills . . . . Atlanta, Ga. . . . . Sept. 26, 1901.
George A. Chace . . . Treas. Bourne Mills . . . Box 115, Fall River, Mass. . . Apr. 25, 1877.
Alfred M. Chadwick, . Asst. Agt. Tremont & Suffolk Mills, Lowell, Mass. . . . Apr. 28, 1904.
John W. Chafee . . . Pres. and Treas. The Sibley Mfg. Co. Augusta, Ga. . . . . Oct. 18, 1900.
Simeon B. Chase . . . Treas. King Philip Mills . . . . . Fall River, Mass. . . Apr. 21, 1875.
Chas. E. Childs . . . . Treas. Hampton Co., Asst. Treas. West Boylston Co. . . . . Northampton, Mass. . Oct. 1, 1903.
Clarence N. Childs . . Asst. Supt. Hamilton Manufg. Co. . . . . 43 Pine St., Lowell, Mass. . . . Apr. 24, 1895.
Elmer G. Childs . . . Agt. Boston Duck Co. . . . . Bondsville, Mass. . . Oct. 26, 1892.
Jno. H. C. Church . . . Treas. and Gen. Mgr. Monument Mills, Housatonic, Mass. . Apr. 28, 1897.
Daniel Clark . . . . . 16 Fifth ave., Lowell, Mass., . . . Apr. 23, 1903.
Ernest E. Clark . . . Mech. Supt. Montreal Cotton Co. . . Valleyfield, P. Q. . . Apr. 29, 1896.
E. N. Clemence . . . Cotton Manufacturer . . . . . Charlotte, N. C. . . . Apr. 28, 1897.
W. H. Cloher, Jr. . . . Treas. and Agt. Utica Cotton Co. Capron, Oneida Co., N. Y., Sept. 22, 1896.
Josiah G. Coburn . . . . . 99 Washington St., Newton, Mass. . . . Apr. 20, 1865.
Charles H. Collins . . Supt. Berkeley Co. . . . . Ashton, R. I. . . . . Apr. 26, 1900.
John A. Collins . . . . Supt. American Linen Co. . . . . 73 Cottage St., Fall River, Mass. . . Oct. 31, 1883.
B. B. Comer . . . . . Pres. and Treas. Avondale Cotton Mills . . . . . Birmingham, Ala. . . Apr. 26, 1900.
Frank B. Comins . . . Treas. American Moistening Co. . . . . 150 Devonshire St., Room 67, Boston, Mass. . . . . Oct. 28, 1891.
Caesar Cone . . . . . Pres. Proximity Mfg. Co. . . . . Greensboro, N. C. . . Apr. 26, 1900.
John J. Connell . . . . Agt. Tremont & Suffolk Mills . . . Lowell, Mass. . . . Apr. 27, 1892.
Halsey Connett . . . . Supt. Clark Mile End Spool Cotton Co. East Newark, N. J. . Oct. 2, 1902.
Peter H. Corr . . . . Treas. Greenwich Bleachery . . . . Taunton, Mass. . . . Apr. 24, 1895.
Frank H. Cotton . . . . . Fayetteville, N. C. . . Apr. 27, 1899.
Lyman M. Cousens, . . Pres. Dana Warp Mills . . . . . Portland, Me. . . . Apr. 24, 1902.

Alphonse S. Covel . . Treas. Tremont and Suffolk Mills, ... P. O. Box 1716, 70 Kilby St., Boston, Mass. . . . Oct. 31, 1877.
Richard Cowell . . . . . 290 Summer St., New Bedford, Mass. . Apr. 24, 1902.
William W. Crapo . . Pres. Wamsutta Mills . . . . . New Bedford, Mass. . Sept. 29, 1898.
William J. Cray . . . Supt. Aldrich Mfg. Co. . . . . Moosup, Conn. . . . Apr. 25, 1901.
Mark B. Creed . . . . Supt. 1, 2, 3 Wamsutta Mills . . . New Bedford, Mass. . Oct. 1, 1903.
George Crompton, . . Treas. Wachusett Mills and member firm Crompton-Thayer Loom Co., Worcester, Mass. . . Oct. 28, 1897.
John B. Cudlip . . . . Mgr. Cornwall & York Cotton Mills Co. . . . . St. John, N. B. . . . Apr. 28, 1897.
H. H. Culver . . . . . Supt. Elizabeth Poole Mills . . . . . 39 Ashland St., Taunton, Mass. . . . Apr. 28, 1897.
Henry S. Culver . . . Supt. Westville Cotton Mills . . . . Taunton, Mass. . . . Apr. 28, 1897.
A. G. Cumnock . . . . Treas. Appleton Co. . . . Box 2284, Lowell, Mass. . . . July 19, 1865.
Andrew J. Currier . . Gen. Supt. N. E. Cotton Yarn Co. . Taunton, Mass. . . . Apr. 25, 1888.

Philip Dana . . . . . Supt. Dana Warp Mills . . . . . Westbrook, Me. . . Sept. 29, 1898.
Woodbury K. Dana . . Treas. Dana Warp Mills . . . . . Westbrook, Me. . . . Apr. 25, 1888.
Albert W. Danforth . . Mech. Eng. Shanghai Cot. Cloth Mills, Shanghai, China . . 881 Bridge St., Lowell, Mass. . . . Apr. 27, 1881.
A. Lockwood Danielson Asst. Treas. Quinebaug Co., Box 900, Providence, R. I. . . Sept. 27, 1894.
J. DeForest Danielson { Asst. Treas. Lockwood Co. & Lewiston Bleachery & Dye Works } Providence, R. I. . . Sept. 27, 1894.
John W. Danielson . . Treas. Lockwood Co., Ponemah Mills, Quinebaug Co., Wauregan Co., Lewiston B. & D. Works, Box 900, Providence, R. I. . . July 15, 1868.
E. W. Davenport . . Supt. Brighton Mills . . . . . Passaic, N. J. . . . . Apr. 23, 1903.
Bradford D. Davol . . Pres. Barnard Mfg. Co., P. O. Box 93, Fall River, Mass. . . Apr. 25, 1877.
Albert Deabill . . . . Gen. Mgr., Reading Hosiery Co., . Reading, Pa., . . . Apr. 25, 1901.
Augustus De Cort . . . Treas. Beacon Mfg. Co. . . . . P. O. Box 2815, 65 Franklin St., Boston, Mass. . . . . Apr. 26, 1900.
George DeForest . . . Treas. Utica Steam & Mohawk Valley Cotton Mills . . . Utica, New York . . Oct. 28, 1897.
William P. Dempsey . Treas. and Mgr. Dempsey Bleachery and Dye Works . . Pawtucket, R. I. . . Apr. 28, 1886.
Charles W. Dennett . . Vice Pres. and Gen. Mgr. Hadley Mills, ... So. Hadley Falls, Mass. . . . Oct. 29, 1890.
Edward P. Dennis . . . . . Lowell, Mass. . . . Apr. 25, 1888.
Charles A. Denny . . . . . Leicester, Mass. . . Apr. 25, 1888.
P. Y. DeNormandie . . Treas. Pepperell Mfg. Co. . . . . 30 Kilby St., Boston, Mass. . . . Apr. 29, 1896.
Charles Owen Dexter . Mgr. Canadian Colored Cotton Mills Co. Ltd. . . . . Hamilton, Ont., Can. Apr. 24, 1895.
Henry C. Dexter, . . . Agt. and Sec. Greene & Daniels Mfg. Co. . . . . Pawtucket, R. I. . . Apr. 25, 1901.
Lewis Dexter, Jr. . . . Mgr. The Canadian Colored Cotton Mills Co., Ltd. . . . . Milltown, N. B. . . . Apr. 27, 1899.
Albert W. Dimick . . . Agt. Fisher Mfg. Co. . . . . Fisherville, Mass. . . Apr. 25, 1894.

Bradford C. Divine . . Supt. Utica Willowvale Bleaching Co. Chadwicks, N. Y. . . Apr. 27, 1899.
Robert Dow, ... Partner in Solway Mills, ... Westerly, R. I. . . . April 25, 1901.
Arthur J. Draper . . . Treas. Pell City Mfg. Co. . . . . Pell City, Ala. . . . Apr. 23, 1903.
Eben S. Draper . . . Agt. Draper Co. . . . . Hopedale, Mass. . . Oct. 31, 1888.
George A. Draper . . . Treas. Draper Co. . . . . Hopedale, Mass. . . Oct. 31, 1888.
George Otis Draper . . Sec'y Draper Co. . . . . Hopedale, Mass. . . Apr. 24, 1895.
William F. Draper . . Pres. Draper Co. . . . . Hopedale, Mass. . . July 17, 1867.
Harry K. Drew . . . Supt. Clinton Mfg. Co., 93 Clinton St., Woonsocket, R. I. . . Apr. 24, 1902.
O. D. Drew . . . . . Supt. Dwight Manufacturing Co. . . . . Chicopee, Mass . Oct. 2, 1902.
James B. Duggan . . . Pres. Union Bleaching and Finishing Co. . . . . Greenville, S. C. . . Oct. 2, 1902.
Frederic C. Dumaine, . Treas. Amory Mfg. Co., Box 2879 . . . . . 64 Ames Building, Boston, Mass. . . . April 25, 1901.
Joseph M. Dunham . . . . . 43 Edwards St., Springfield, Mass. . . Oct. 26, 1892.
John H. Dunn . . . . Gen. Supt. Tremont & Suffolk Mills Lowell, Mass. . . . Oct. 1, 1903.
Frank J. Dutcher . . . Asst. Agt. Draper Co. . . . . Hopedale, Mass. . . Apr. 24, 1902.
Frank H. Dwelly . . . Treas. Tecumseh Mills . . . . . Fall River, Mass. . . Apr. 27, 1899.
David H. Dyer . . . . D. H. Dyer & Son, Mill Engineers, P. O. Box 582, . . . 6, 7 and 8 Pocassett Bank Building, Fall River, Mass. . . Oct. 18, 1871.

Benjamin M. Earle . . Prop. Merchants Dye Works . . . . East Dedham, Mass. Sept. 26, 1901.
Wm. Ambrose Eastman, Gen. Mgr. Hooper Knitting Co. . . Lowell, Mass. . . . Apr. 24, 1878.
Russell W. Eaton . . . Agt. Cabot Manufg. Co. . . . . Brunswick, Me. . . . Oct. 27, 1887.
John Eccles . . . . . Agt. Ponemah Mills . . . . . Taftville, Conn. . . . Apr. 27, 1892.
Oscar Elsas . . . . . Vice-Pres. Fulton Bag & Cotton Mills, ... P. O. Box 773, Atlanta, Ga. . . . . Apr. 28, 1897.
Frederick W. Ely . . . Agt. Columbian Manufg. Co. . . . Greenville, N. H. . . Apr. 25, 1888.
H. B. Estes . . . . . Agt. Continental Mills . . . . . Lewiston, Me. . . . Apr. 26, 1893.
John H. Estes . . . . Cotton Manufacturer . . . . . Fall River, Mass. . . Apr. 23, 1903.
William Evans . . . . Treas. Wampanoag Mills . . . . . Fall River, Mass. . Apr. 29, 1896.
D. A. Everly . . . . . Pres. . . . . 96 Broad St., Pawtucket, R. I. . . Apr. 24, 1902.

Charles F. Farrar . . . . . 49 Coggeshall St., Fall River, Mass. . . Oct. 28, 1897.
George E. Farrell . . . Sec. Ontario Knitting Co. and Standard Yarn Mills, ... Oswego, N. Y. . . . Oct. 18, 1900.
James T. Ferguson . . Supt. Warwick Mills . . . . . Centreville, R. I. . . Oct. 5, 1899.
Frank S. Field . . . . Supt. & Agt. Massaemit Yarn Mills . Shattuckville, Mass. . Oct. 25, 1895.
Eugene Finocchiaro, . Asst. Supt. Cohannet Mills, ... 48 Adams St., ... Taunton, Mass., . . Apr. 28, 1904.
William Firth . . . . Pres. American Moistening Co. & Wm. Firth Co. . . . . P. O. Box 1460, 150 Devonshire St., Room 67, Boston, Mass. Apr. 25, 1888.
Charles W. Fisher, . . Asst. Supt. Fisher Mfg. Co. . . . . Fisherville, Mass. . . Apr. 25, 1901.
Henry E. Fisher . . . Vice-Pres. & Agt. Atlanta Cotton Mills Atlanta, Ga. . . . . Oct. 25, 1895.
Frederick A. Flather . Mgr. of Works, Manufacturing International Harvester Co. . . . . 7 Monroe St., Chicago, Ill. . . . . Apr. 29, 1891.
F. C. Fletcher . . . . Vice Pres. Lawton Spinning Co. . . . . 621 Banigan Building, Providence, R. I. . . Oct. 18, 1900.

Henry J. Forsyth	Supt. Cooleemee Cotton Mill,	Cooleemee, N. C.	Oct. 1, 1903.
M. F. Foster		Milford, N. H.	Apr. 17, 1872.
Philip H. Fowler	417 Monmouth St.,	Gloucester City, N. J.	Nov. 30, 1881.
Edward W. France	Dir. of Philadelphia Textile School, 320 So. Broad St.,	Philadelphia, Pa.	Sept. 22, 1896.
Arthur C. Freeman	Textile Finishing Machinery Co. 17 Exchange Place,	Providence, R. I.	Apr. 27, 1899.
Simon Friedberger	Pres. Friedberger Mfg. Co. Germantown, Logan Station,	Philadelphia, Pa.	Apr. 23, 1903.
John W. Fries	Managing Partner, F. & H. Fries & Pres. Arisba Mills Co.	Winston-Salem, N.C.,	Oct. 18, 1900.
C. H. Frisbie	Agt. Attawaugan Co.	Norwich, Conn.	Oct. 29, 1890.
Hachiro Fukuhara,	Kanegafuchi Spinning Co.,	Hiogo, Japan,	Apr. 28, 1904.
W. T. Galey	Pres. Aberfoyle Manufg. Co.	Chester, Pa.	Apr. 28, 1897.
William Gammell	Agt. Berkeley Co.	Providence, R. I.	Oct. 28, 1885.
James G. Garland		Saco, Me.	Oct. 29, 1879.
Edward T. Garsed		Charlotte, N. C.	Apr. 27, 1898.
Walter R. Garsed	Mgr. Wingohocking Cotton Mills Frankford,	Philadelphia, Pa.	Oct. 1, 1903.
E. Stanley Gary	Vice Pres. and Gen. Mgr. Gary Mfg. Co. 306 Fidelity Bldg.	Baltimore, Md.	Oct. 1, 1903.
James A. Gary	Pres. Gary Mfg. Co. 306 Fidelity Bldg.	Baltimore, Md.	Apr. 25, 1883.
James Gee	Supt. Interlaken Dye Works	Fiskville, R. I.	Apr. 27, 1898.
Charles E. Getchell	Pres. Waltham Emery Wheel Co. Bacon St.,	Waltham, Mass.	Oct. 30, 1889.
William C. Godfrey	Agt. Indian Orchard Co.	Indian Orchard, Mass.	Oct. 29, 1890.
Otto Goetze,	Partner and Gen. Mgr. Glasgow Mills, Huntington and Jasper Sts., Kensington Sta.,	Philadelphia, Pa.	Apr. 24, 1902.
Alfred M. Goodale	Treas. Boston Manufg. Co. 50 State St.,	Boston, Mass.	Apr. 25, 1883.
Frederick B. Gordon	Pres. Columbus Mfg Co.	Columbus, Ga.	Apr. 26, 1900.
Charles H. Gorton	Supt. Columbus Mfg. Co.	Columbus, Ga.	Apr. 25, 1894.
Marcellus Gould	Pres. and Mgr. N. H. Spinning Mills,	Penacook, N. H.	Sept. 22, 1896.
George P. Grant, Jr.	Treas. Grant Yarn Co.	Fitchburg, Mass.	Sept. 27, 1894.
D. W. Gray	Supt. Skenandoa Cotton Co.	Utica, N. Y.	Oct. 26, 1892.
R. A. Gray	Supt. Rodman Manufg. Co.	Allenton, R. I.	Apr. 24, 1895.
Edwin Farnum Greene,	Asst. Treas. Dwight Mfg. Co. & Pres. Lockwood, Greene & Co.	Boston, Mass.	Apr. 28, 1904.
Frederick Stuart Greene	Mgr. Transmission Rope Dept., The American Mfg. Co. 65 Wall St.,	New York City	Oct. 1, 1903.
Joseph Warren Greene	Supt.	Wickford, R. I.	Apr. 29, 1896.
William C. Greene	Treas. Peace Dale Manufg. Co.	Peace Dale, R. I.	Oct. 27, 1886.
John T. Greenwood	R. Greenwood & Bault 4720 Leiper St., Frankford,	Philadelphia, Pa.	Apr. 26, 1900.
S. Greenwood	Mgr. Canadian Col'd Cot. Mills Co. Ltd.	Cornwall, Ontario	Oct. 5, 1899.

John Gregson . . . . Agt. Fiskdale Mills . . . . . Fiskdale, Mass. . . . Apr 24, 1895.
Maxwell Grierson . . . Gen. Mgr. Jas. Chadwick & Bro., Ltd., Jersey City, N. J. . . Apr. 27, 1898.
Frederick Grinnell . . Pres. Gen. Fire Extinguisher Co. . . New Bedford, Mass. . Apr. 24, 1878.
David Grove . . . . . Supt. U. S. Cotton Co. . . . . Central Falls, R. I. . Apr. 27, 1898.
Henry S. Grove . . . Pres. Argo Mills Co., ... 318 Marine and Merchant Bldg., Philadelphia, Pa. . . Apr. 27, 1898.
Louis I. Guion . . . . Supt. Columbia Mills Co., ... Columbia, S. C. . . . Oct. 2, 1902.
Arthur H. Gulliver . . Agt. Boston Mfg. Co. . . . . Waltham, Mass. . . Apr. 24, 1889.

William J. Hadfield . . Newburgh Steam Mills, ... 124 Smith St., Newburgh, N. Y. . . Apr. 27, 1899.
Frank J. Hale . . . . Gen. Agt. Saco and Pettee Machine Shops . . . . . Newton Upper Falls, Mass. . Apr. 27, 1892.
Walter B. Hall . . . . Supt. Pontaic Mill, B. B. & R. Knight, Pontiac R. I. . . . Apr. 25, 1901.
William E. Hall . . . Treas. and Mgr. Shaw Stocking Co., Lowell, Mass. . . . Apr. 27, 1892.
Z. D. Hall . . . . . Supt. Berkshire Cotton Mfg. Co. . . . . 70 Orchard St., P. O. Box 963, Adams, Mass. . . . Oct. 29, 1879.
William Halliwell, . . Agt. Providence and Woonsocket Mills of the Lawton Spin- . . . . . ning Co., Woonsocket, R. I. . Sept. 26, 1901.
John H. Hambly . . . Treas. Quidnick Manufg. Co. . . . . 49 Westminster St., Providence, R. I. . . Apr. 24, 1895.
Arthur M. Hamilton . . Supt. Hargraves and Parker Mills . . . . . 267 Hanover St., Fall River, Mass. . . Apr. 28, 1897.
John F. Hamlet . . . Manufacturer . . . P. O. Box 160, Fall River, Mass. . . Oct. 31, 1888.
Joseph O. Hannum . . . . . 1805 10th Ave. South, Birmingham, Ala. . . Apr. 30, 1890.
Peter Hardman . . . Supt. American Thread Co., Willimantic Mills . . . . . Willimantic, Conn. . Apr. 23, 1903.
A. G. Harris . . . . . West Warren Cotton Mills, ... West Warrren, Mass. Sept. 26, 1901.
Henry F. Harris . . . Treas. West Boylston Manufg. Co. . . . . 340 Main St., Worcester, Mass. . . Apr. 30, 1890.
W. G. Hartford . . . . Agt. Hamlet Textile Co. . . . . Woonsocket, R. I. . . Apr. 23, 1903.
William D. Hartshorne Agt. Arlington Mills . . . . . Lawrence, Mass. . . Apr. 27, 1899.
Walter M. Hastings . . Asst. Agt. Arlington Mills . . . . . Lawrence, Mass. . . Apr. 23, 1903.
Chester D. Hatch . . Supt. Exeter Mfg. Co., ... Exeter, N. H. . . . Apr. 28, 1904.
Samuel E. Hathaway . Supt. Fall River Iron Works Co. . . Fall River, Mass. . . Sept. 27, 1894.
William Hathaway . . Supt. Barnard Manufg. Co. . . . . Fall River, Mass. . . Apr. 25, 1894.
William B. Hawes . . Yarn Broker . . . 108 Bedford St., ... P. O. Box 733, Fall River, Mass. . . Apr. 24, 1895.
Alfred Hawkesworth . Supt. Merchants' Cotton Co. . . . . Montreal, P. Q. . . . Apr. 26, 1893.
Fred Hawkesworth . . Asst. Supt. Merchants' Cotton Co. . Montreal, P. Q. . . . Sept. 22, 1896.
William Hayes . . . . Agt. Barker Mill . . . . . Auburn, Me. . . . . Apr. 30, 1879.
W. G. Henderson . . . Agt. Falls Co. . . . . Norwich, Conn. . . . Apr. 29, 1896.
A. E. Henry, ... Mfr. Partner in Solway Mills, . . . Westerly, R. I. . . . Apr. 25, 1901.
James Henry . . . . . Thos. Henry & Sons . . . . . Trenton Ave. and Tioga St., Philadelphia, Pa. . . Oct. 1, 1903.

William G. Henry . . Thos. Henry & Sons . . . . . Trenton Ave. and Tioga St., Philadelphia, Pa. . . Oct. 1, 1903.
Arthur N. Hersom, . . Asst. Supt. Tremont & Suffolk Mills, Lowell, Mass. . . . Apr. 28, 1904.
Ernest L. Hersom . . Supt. Nockege Mill . . . . . Fitchburg, Mass. . . Apr. 23, 1903.
T. I. Hickman, ... Pres. and Treas. Graniteville Mfg. Co. . . . . Leonard Bldg., Augusta, Ga. . . . . Apr. 25, 1901.
Hiram Higham . . . . Supt. 6 and 7 Wamsutta Mills . . . New Bedford, Mass. . Oct. 1, 1903.
Ernest L. Hill . . . . Treas. Renfrew Mfg. Co. . . . . 320 Broadway, New York City . . . Apr. 24, 1902.
William H. Hill . . . Pres. Renfrew Mfg. Co., 40 Water St., Boston, Mass. . . . Apr. 24, 1902.
George H. Hills . . . Treas. Davol Mills & Stevens Mfg. Co., Fall River, Mass. . . Oct. 25, 1895.
Charles H. Hobbs . . Agt. Thorndike Co. . . . . Thorndike, Mass. . . Apr. 28, 1886
Franklin W. Hobbs . . Treas. Arlington Mills . . . . . P. O. Box 5317, 78 Chauncy St., Boston, Mass. . . . Apr. 27, 1899.
William Henry Hobbs . Asst. Supt. Johnson & Johnson Co., New Brunswick, N. J. Apr. 24, 1902.
Louis L. Hohn . . . . Cor. Connecticut Ave. and McDonald St., New London, Conn. Apr. 28, 1897.
Charles M. Holmes . . Agt. Manomet Mills, ... Box 96, New Bedford, Mass. . . Apr. 27, 1899.
Gideon F. Holmes . . Treas. and Gen. Mgr. Plymouth Cor- . . . . . dage Co. . . . . No. Plymouth, Mass. . Oct. 30, 1889.
George W. Holt . . . Agt. Monohansett Manufg. Co. . . Putnam, Conn. . . . Oct. 29, 1879.
John H. Holt . . . . Supt. Totokett Mills Co. . . . . Versailles, Conn. . . Apr. 23, 1903.
Walter L. Holt . . . . Pres. Holt-Morgan Mills . . . . . Fayetteville, N. C. . . Oct. 18, 1900.
William P. Holt . . . Supt. Barnaby Mills . . . . . Fall River, Mass. . . Oct. 25, 1893.
Wm. E. Hooper . . . Mgr. Woodberry Div. of Mt. Vernon Woodberry Co. . . . . Room 804, Continental Trust Bldg., Baltimore, Md. . . . Apr. 23, 1903.
H. B. Hopson . . . . Supt. Spool Cotton Dept., Bibb Mfg. Co. . . . . Box 98, Macon, Ga. . . Apr. 28, 1904.
Edward W. Houghton . Supt. Globe Mill . . Manville Co., Woonsocket, R. I. . . Apr. 24, 1902.
Henry S. Houghton, Jr. Supt. Paul Whitin Manufg. Co. . . Northbridge, Mass. . Apr. 24, 1895.
W. C. Houston . . . . Pres. Hope Mills Manufg. Co. . . . . 333 Drexel Building, Philadelphia, Pa. . . Apr. 28, 1897.
Elisha H. Howard . . Cotton Goods Broker, 20 Market Sq., Providence, R. I. . . Apr. 25, 1883.
Henry S. Howe . . . . Dry Goods Commission . . . . . 89 Franklin St., Boston, Mass. . . . Oct. 31, 1877.
Albert C. Hoy . . . . . Woonsocket, R. I. . . Apr. 27, 1898.
Charles W. Hubbard . Treas. and Sec. Ludlow Mfg. Associates . . . . . 133 Essex St., Boston, Mass. . . . Apr. 25, 1901.
Otis L. Humphrey, . . Harding, Whitman, & Co., 78 Chauncy St., Boston, Mass. Apr. 25, 1901.
Arthur W. Hunking . . . . . 374 Stevens St., Lowell, Mass. . . . Apr. 24, 1895.

D. Edwin Irving . . . Treas. The Irving & Leiper Mfg. Co., Chester, Pa. . . . . Oct. 28, 1897.

J. E. Jenckes . . . . . Treas. E. Jenckes Manufg. Co. & E. Jenckes Spinning Co. . . . . Pawtucket, R. I. . . Apr. 24, 1895.
Edward B. Jennings . . Treas. Samoset Co. . . . . Valley Falls, R. I. . . Sept. 29, 1898.

David L. Jewell . . . Agt. China, Webster & Pembroke Mills . Suncook, N. H. . Apr. 20, 1865.
Leonard Johnson . . . Supt. Wampanoag Mills . . . . . 33 Cambridge St., Fall River, Mass. . . Oct. 1, 1903.
David S. Johnston . . Gen. Supt. Harmony Mills . . . . Cohoes, N. Y. . . . Oct. 28, 1891.
Gordon A. Johnstone . Agt. Danielson Cotton Co. . . . . Danielson, Conn. . . Apr. 23, 1903.
W. T. Jordan . . . . Mgr. Mountain Island Mfg. Co. . . Mountain Island, N. C. Oct. 25, 1895.

W. E. Keach . . . . . Supt. Grant Yarn Co., 21 Burnap St., Fitchburg, Mass. . . Oct. 26, 1892.
Roland R. Kelly . . . Supt. Williamstown Manufg. Co. . Williamstown Sta., Mass. Nov. 30, 1881.
George E. Kent . . . . Treas. Exeter Manufg. Co. . . . . Exeter, N. H. . . . Oct. 31, 1888.
Hervey Kent . . . . . Pres. Exeter Manufg. Co. . . . . Exeter, N. H. . . . Apr. 20, 1865.
Nathaniel B. Kerr . . . Treas. Butler Mill . . . . . New Bedford, Mass. . Oct. 26, 1892.
John Kilburn . . . . . Belmont, Mass. . . . Apr. 20, 1865.
Harry W. Kimball . . Supt. Fulton Bag & Cotton Mills . Atlanta, Ga. . . . . Oct. 25, 1895.
William N. Kimball . . Supt. Social and Nourse Mills, Manville Co. . . . . Woonsocket, R. I. . . Apr. 24, 1902.
Emil Kipper . . . . . Vice Pres. Windsor Print Works . . Adams, Mass. . . . . Apr. 24, 1902.
Albert F. Knight . . . Mfr. Fine White Cotton Goods and Yarns . . . . . Box 835, Providence, R. I. . . Oct. 27, 1886.
Jesse A. Knight . . . . Supt. Cohannet Mills . . . . . Taunton, Mass. . . . Oct. 26, 1892.
Stephen A. Knight . . Pres. Hebron Manufg. Co., Box 820, Providence, R. I. . . Oct. 21, 1868.
Walter B. Knight . . . Supt. Madison Mfg. Co. . . . . Huntsville, Ala. . . Apr. 24, 1889.
Webster Knight . . . B. B. & R. Knight's Mills . . . . . 3 Washington Row, Providence, R. I. . . Oct. 31, 1888.

Fred Lacey . . . . . Mgr. Montreal Cotton Co. . . . . Valleyfield, P. Q. . . Apr. 24, 1895.
Elliott Cowdin Lambert Supt. Amoskeag Manufg. Co. . . . Manchester, N. H. . Oct. 25, 1895.
William T. Lang . . . Agt. Brookside Mills . . . . . Knoxville, Tenn. . . Apr. 28, 1897.
Walter H. Langshaw . Agt. Dartmouth Manufg. Corp. . . New Bedford, Mass. . Apr. 29, 1896.
George H. Law . . . Supt. Merchants' Mfg. Co. . . . . 815 Walnut St., Fall River, Mass. . . Apr. 28, 1897.
Harold Lawton . . . . Mgr. Baltic Mills Co. . . . . Baltic, Conn. . . . . Oct. 27, 1886.
John Edward Lawton . Governing Director American Thread Co., ... Matlock, Derbyshire, England . Apr. 25, 1901.
Calvin H. Lee . . . . Supt. Readville Cotton Mills . . . Hyde Park, Mass. . . Apr. 24, 1902.
Evan Arthur Leigh . . Textile Machinery 232 Summer St., Boston, Mass. . . . . Oct. 29, 1890.
J. Colby Lewis . . . . . 23 Ralph St., Olneyville, Providence, R. I. . . Oct. 26, 1892.
Charles F. Libby . . . Supt. Shaw Stocking Co. . . . . Lowell, Mass. . . . Apr. 24, 1902.
Leontine Lincoln . . . Pres. Seaconnet Mills . . . . . Fall River, Mass. . . Apr. 28, 1897.
B. F. G. Linnell . . . Commission Merchant, Yarns, Threads and Twines . . . . . 37 Summit St., P. O. Box 645, Central Falls, R. I. . . Oct. 28, 1897.
Henry F. Lippitt . . . Gen. Mgr. Social and Manville Cos., Providence, R. I. . . Apr. 27, 1881.
William H. Loftus . . Supt. Clark Thread Co. . . . . Newark, N. J. . . . Oct. 28, 1897.
John T. Lord, ... Supt. Pacific Mills, ... Lawrence, Mass. . . Apr. 28, 1904.
Robert W. Lord . . . Agt. R. W. Lord & Co. . . . . Kennebunk, Me. . . Oct. 20, 1869.

Ernest Lovering	Agt. Lyman Mills	Holyoke, Mass.	Apr. 25, 1888.
Henry M. Lovering	Agt. Whittenton Manufg. Co.	Taunton, Mass.	Oct. 27, 1880.
William C. Lovering	Pres. Whittenton Manufg. Co.	50 State St., Boston, Mass.	Oct. 25, 1876.
William M. Lovering	Lawrence & Co.,	24 Thomas St., New York, N. Y.	Sept. 27, 1894.
Arthur H. Lowe	Treas. Parkhill Mfg. Co., Treas. Wm. Lowe Mfg. Co., Huntsville, Ala.	Fitchburg, Mass.	Oct. 30, 1889.
David Lowe	Supt. Parkhill Manufg. Co.	Fitchburg, Mass.	Apr. 24, 1895.
A. Lawrence Lowell	Trustee	843 Exchange Building, 53 State St., Boston, Mass.	Apr. 25, 1901.
Dudley T. Lyall	Sec. Brighton Mills	Passaic, N. J.	Sept. 22, 1896.
William L. Lyall	Treas. Brighton Mills	Passaic, N. J.	Oct. 26, 1892.
Herbert Lyman	39 Beacon St., P. O. Box 1717,	Boston, Mass.	Oct. 25, 1895.
Ronald T. Lyman	Asst. Treas. Boston Mfg. Co.	P. O. Box 1717, Boston, Mass.	Oct. 1, 1903.
Otis G. Lynch	Supt. Enterprise Manufg. Co.	Augusta, Ga.	Oct. 25, 1895.
Alvin S. Lyon	Supt. Bigelow Co.	Lowell, Mass.	Apr. 26, 1882.
James R. MacColl	Treas. Lorraine Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Charles L. Macomber	Pres. Winthrop Cotton Yarn Co.	Taunton, Mass.	Apr. 24, 1895.
Frederick B. Macy,	Treas. Soule Mills,	New Bedford, Mass.	Apr. 25, 1901.
Amos G. Maddox	Supt. Linwood Mill	Linwood, Mass.	Oct. 18, 1900.
Charles T. Main	Mech. and Mill Engineer, Dean & Main, 53 State St., 1112 Exchange Bldg.,	Boston, Mass.	Oct. 28, 1885.
Alexander Makepeace	Supt. Richard Borden Mfg. Co.	Fall River, Mass.	Oct. 1, 1903.
Charles R. Makepeace	Mill Engineer	Box 973, Providence, R. I.	Apr. 30, 1890.
Vladimir Malinin, M. E.,	Prochoroff Three Hill Mfg. Co.	Moscow, Russia	Apr. 23, 1903.
Arthur B. Mann	J. H. Martin & Co., 99 Franklin St.,	New York, N. Y.	Apr. 25, 1894.
Charles H. Manning	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Henry F. Mansfield	Gen. Supt. Utica Steam Cotton Mills and Mohawk Valley Cotton Mills	Utica, N. Y.	Apr. 30, 1890.
Paul J. Marrs	Treas. Henderson Cotton Mills	Henderson, Ky.	Oct. 28, 1897.
Albert G. Martin	Supt. Kincaid Manufg. Co.	Box 182, Griffin, Spalding County, Ga.	Apr. 30, 1884.
Henry D. Martin	Asst. Supt. Stevens Mfg. Co.	934 Middle St., Fall River, Mass.	Apr. 28, 1897.
Arthur H. Mason	Treas. Barnaby Mfg. Co.	Fall River, Mass.	Oct. 2, 1902.
Philip A. Mathewson	Supt. King Philip Mills	Box 607, Fall River, Mass.	Apr. 24, 1895.
Scott Maxwell,	Agt. Indian Head Mills of Ala.	Cordova, Ala.	Sept. 26, 1901.
Thomas Mayor	Textile Machinery, Thomas Mayor & Son, 26 Olney St.,	Providence, R. I.	Oct. 27, 1880.
Andrew W. McAllister	Supt. Natick Mills,	Natick, R. I.	Apr. 28, 1904.
Robert McArthur	Agt. Pepperell Mfg. Co.	Biddeford, Me.	Apr. 17, 1872.
Thos. McAulifle	Supt. Stevens Mfg. Co.	Fall River, Mass.	Apr. 27, 1898.
Henry G. McCarter	Mgr. John Farnum & Co., Conestoga Mills, 2 and 3	Lancaster, Pa.	Apr. 23, 1903.

Albert E. McDonald	Agt. Lawrenceville Mfg. Co.,	Lawrenceville, Ga.	Oct. 2, 1902.
Fred C. McDuffie	Treas: Everett Mills and York Manufg. Co.	P. O. Box 2934, Boston, Mass.	Oct. 25, 1882.
John G. McFadden	Supt. Nottingham Mill, 314 Dyer St.,	Providence, R. I.	Oct. 1, 1903.
James A. McLane	Supt. Davis Mills	Fall River, Mass.	Oct. 2, 1902.
William G. McLoon	Supt. Lancaster Mills,	Clinton, Mass.	Apr. 27, 1892.
Robert G. McMeehan,	Supt. Uncasville Mfg. Co.	Uncasville, Conn.	Sept. 26, 1901.
William P. McMullan	Agt. Naumkeag Steam Cotton Co.	Salem, Mass.	Sept. 27, 1894.
John Tempest Meats	Agt. Mason Machine Works	Taunton, Mass.	Apr. 27, 1887.
Robert B. Meikle	Supt. Lorraine Mfg. Co.	Westerly, R. I.	Apr. 23, 1903.
Henry P. Meikleham,	Agt. Mass. Mills in Georgia	Lindale, Floyd Co., Ga.	Apr. 26, 1900.
Joseph Mercer	Agt. and Treas. Willimantic Cotton Mills Co.	Willimantic, Conn.	Apr. 24, 1902.
Charles H. Merriman, Jr.	Manville Co., Board of Trade Bldg.,	Providence, R. I.	Apr. 24, 1895.
Joseph Merriam	Pres. Springfield Webbing Co.	Middletown, Conn.	Oct. 2, 1902.
W. H. Miles		Lisbon, Me.	Sept. 22, 1896.
R. M. Miller, Jr.	Pres. & Treas. Elizabeth Mills	Charlotte, N. C.	Sept. 29, 1898.
James I. Milliken	Agt. Everett Mills	Lawrence, Mass.	Oct. 26, 1892.
Roscoe S. Milliken	Agt. Nashua Mfg. Co.	Nashua, N. H.	Apr. 29, 1896.
David Milne	C. J. Milne & Sons	Washington Ave. & 10th and 11th Sts., Philadelphia, Pa.	Apr. 28, 1897.
A. B. Mole	Gen. Mgr. Dominion Cotton Mills Co.,	Montreal, P. Q.	Apr. 24, 1895.
Edward A. Mongeon	Supt. Lonsdale Mills	Lonsdale, R. I.	Apr. 24, 1895.
J. R. Montgomery	Pres. The J. R. Montgomery Co.	Windsor Locks, Conn.	Sept. 29, 1898.
George A. Moody	Supt. West Warren Cotton Mills	West Warren, Mass.	Apr. 27, 1899.
Fred W. Moore	Agt. Cordis Mills	P. O. Box 582, Millbury, Mass.	Apr. 27, 1892.
James Sumter Moore	Sec. and Treas. Olympia & Richland Cotton Mills	Columbia, S. C.	Apr. 26, 1900.
George B. Morison	Pres. Ballou Yarn Co., 77 Summer St.,	Boston, Mass.	Apr. 24, 1895.
Albert H. Morton	Supt. Kitson Machine Co.	Lowell, Mass.	Oct. 28, 1891.
E. P. Morton,	Agt. Stevens Linen Works	Webster, Mass.	Sept. 26, 1901.
Oliver H. Moulton	Supt. Hamilton Manufg. Co.	Lowell, Mass.	Apr. 20, 1865.
Farquharson J. Muir	Cone Export & Commission Co.	Greensboro, N. C.	Apr. 27, 1892.
John Neild	Agt. Grinnell Mfg. Corp.	New Bedford, Mass.	Apr. 25, 1901.
Will Nelson	Head Instructor of Weaving, Lowell Textile School	Lowell, Mass.	Apr. 23, 1903.
Roscius C. Newell	Supt. Palmer Mill	Three Rivers, Mass.	Oct. 25, 1895.
William G. Nichols	Sec. and Treas. Springstein Mills and Pres. Wylie Mills	Chester, S. C.	Oct. 25, 1893.
William M. Nixon	Pres. Atlanta Woolen Mills	Atlanta, Ga.	Oct. 5, 1899.
Albert W. Noone,	Prop. & Mgr. Jos. Noone's Son's Co.	Peterboro, N. H.	Sept. 26, 1901.
Franklin Nourse	Agt. Lawrence Manufg. Co.	Lowell, Mass.	Apr. 24, 1878.
S. Odenheimer	Treas. Lane Mills	New Orleans, La.	Oct. 25, 1893.
Charles K. Oliver	Treas. Continental Bldg.,	Baltimore, Md.	Sept. 27, 1894.

William B. Orr,	Supt. Renfew Mfg. Co.	Adams, Mass.	Apr. 28, 1904.
J. Edward Osborn	Treas. American Linen Co.	Fall River, Mass.	Apr. 28, 1897.
Henry Osgood,	6 Monroe St., P. O. Box 204.	Salem, Mass.	Apr. 25, 1901.
Frederick Ott	Supt. Hamlet Textile Co.	Woonsocket, R. I.	Apr. 23, 1903.
Herbert W. Owen	Supt. Cocheco Mfg. Co.	Dover, N. H.	Oct. 5, 1899.
Logan Owen	Supt. Mill No. 1, Bibb Mfg. Co.,	Macon, Ga.	Apr. 28, 1904.
Oscar L. Owen	Mech. and Mill Eng. Whitin Machine Works	Whitinsville, Mass.	Apr. 25, 1894.
Elmer E. Page	Agt. York Manufg. Co.	Saco, Me.	Apr. 27, 1892.
Walter H. Paige	Supt. Wamsutta Mills	New Bedford, Mass.	Oct. 1, 1903.
O. B. Parker	Supt. Quidnick Mfg. Co.	Quidnick, R. I.	Apr. 24, 1895.
Samuel L. Parker	Supt. Turners Falls Cotton Mills	Box 627, Turners Falls, Mass.	Apr. 29, 1896.
Walter E. Parker	Agt. Pacific Mills, 217 Haverhill St.,	Lawrence, Mass.	Apr. 25, 1877.
Duncan D. Parmly	Treas. Johnson Mfg. Co. and Dunbar Mills Co.	160 Broadway, New York, N. Y.	Sept. 22, 1896.
Samuel F. Patterson	Pres. and Treas. Thistle Mills Co.	Ilchester, Md.	Oct. 18, 1900.
John W. Pead	Agt. Merrimack Manufg. Co.	Box 1231, Lowell, Mass.	Apr. 26, 1893.
James R. Pearce		Pell City, Ala.	Oct. 25, 1895.
William C. Peirce	Pres. Elizabeth Mills . 564 Eddy St.,	Providence, R. I.	Apr. 24, 1895.
William D. Pennell	Agt. Hill Manufg. Co.	Lewiston, Me.	Apr. 16, 1873.
Haven C. Perham	Treas. Kitson Machine Co.	Lowell, Mass.	Apr. 30, 1879.
Hadley D. Perkins	Mem. firm Sharp, Perkins & Co., Handkerchief Mfrs.	Woonsocket, R. I.	Apr. 28, 1904.
Henry C. Phillips	Asst. Gen. Supt. Harmony Mills	Cohoes, N. Y.	Apr. 25, 1894.
Benjamin Phipps	Merchant	4 Winthrop Sq. Boston, Mass.	Sept. 29, 1898.
Albert R. Pierce	Supt. Pierce Mfg. Corp.	New Bedford, Mass.	Oct. 5, 1899.
Andrew G. Pierce, Jr.	Treas. Pierce Manufg. Corp.	P. O. Box 34, New Bedford, Mass.	Apr. 24, 1895.
Reuben Pilling, Jr.		104 Harrison St., Providence, R. I.	Apr. 29, 1896.
Charles H. Plummer	Agt. Great Falls Manufg. Co., and Salmon Falls Mfg. Co.	Somersworth, N. H.	Apr. 25, 1888.
Charles T. Plunkett	Sec. Berkshire Cotton Mfg. Co.	Adams, Mass.	Apr. 28, 1897.
William C. Plunkett	Mgr. W. C. Plunkett & Sons	Adams, Mass.	Oct. 1, 1903.
Charles H. Potter,	Supt. Montreal Cotton Co.,	Valleyfield, P. Q.,	Apr. 25, 1901.
Joseph H. Potter, Jr.	Supt. Durfee Mills	Fall River, Mass.	Apr. 27, 1899.
J. F. Powers	Supt. Spinning Mill	Middletown, Conn.	Oct. 5, 1899.
Lavater W. Powers	Supt. Bristol Mfg. Co.	141 Merrimac St., New Bedford, Mass.	Oct. 1, 1903.
Herbert L. Pratt	Agt. Bates Manufg. Co.	Lewiston, Me.	Oct. 27, 1875.
George E. Prest	340 Highland St., Newton Square,	Worcester, Mass.	Apr. 24, 1902.
John E. Prest	340 Highland St., Newton Square,	Worcester, Mass.	Apr. 17, 1872.

M. W. Quinn . . . . . Agt. Hamilton Woolen Co. . . . . Amesbury, Mass. . . Oct. 27, 1886.

John W. Ramsbottom . Supt. Brighton Mills, ... Passaic N. J. . . . . Apr. 24, 1902.
Theodore Ellis Ramsdell, Gen. Supt. Monument Mills . . . . Housatonic, Mass. . Apr. 23, 1903.
Emory S. Rathbun . . Supt. Pequot Mills . . . . . Montville, Conn. . . Apr. 27, 1899.
M. A. Rawlinson . . . . . 38 Butterfield St., Lowell, Mass. . . . Apr. 24, 1895.
John F. Reardon . . . Supt. Millville Mfg. Co. . . . . Millville, N. J. . . . Apr. 26, 1900.
Robert Redford . . . Mfr. . . . . Box 28, Lawrence, Mass. . . Apr. 26, 1882.
R. S. Reinhardt . . . . Treas. and Mgr. Elm Grove Cotton Mills . . . . . Lincolnton, N. C. . . Apr. 27, 1898.
L. B. Renfrew . . . . Treas. Renfrew Mfg. Co. . . . . Adams, Mass. . . . Oct. 5, 1899.
T. H. Rennie . . . . . Supt. Graniteville Mfg. Co. . . . . Graniteville, S. C. . . Oct. 18, 1900.
Frederick W. Reynolds, Supt. Potomska Mills, ... Box 299, ... 20 Fifth St., New Bedford, Mass. . Apr. 26, 1900.
Francis H. Rice . . . . Pres. Holbrook Mfg. Co. . . . . Millbury, Mass. . . . Apr. 28, 1880.
John Bion Richards . . Treas. Davis Mills . . . . . Fall River, Mass. . . Apr. 24, 1902.
Charles H. Richardson Agt. Lancaster Mills . . . . . Clinton, Mass. . . . Apr. 24, 1889.
W. H. Richmond . . . Supt. Bibb Mill No. 2 . . . . . Macon, Ga. . . . . Oct. 28, 1897.
Harry J. Ricketson, . . Supt. Merchants' Mfg. Co. . . . . Fall River, Mass., . Apr. 28, 1904.
Walter Rigby . . . . Bibb Mfg. Co. . . 3163 First Ave., Columbus, Ga. . . . Apr. 26, 1900.
Charles E. Riley . . . Textile Machinery, C. E. Riley & Co. . . . . 65 Franklin St., Box 2815, Boston, Mass. . . . Apr. 25, 1888.
William H. Ritter . . . Gen. Supt. and Buyer Johnson & Johnson . . . . . 266 George St., New Brunswick, N. J. Apr. 26, 1900.
George W. Robbins . . Supt. Dyerville Mfg. Co., ... 610 Manton Ave., Providence, R. I. . . . Apr. 28, 1897.
Benj. H. Roberts . . . General Mill Supplies 163 Grove St., Fall River, Mass. . . Apr. 26, 1900.
Charles D. Robinson . Supt. Crompton Co. . . . . Crompton, R. I. . . . Sept. 27, 1894.
William A. Robinson . Asst. Supt. Manville Co. . . . . Woonsocket, R. I. . Apr. 29, 1896.
William H. Robinson . Supt. No. 3 Harmony Mill . . . . Cohoes, N. Y. . . . Apr. 24, 1902.
W. H. Rose . . . . . Sec'y & Treas. Richland, Granby and Olympia Cotton Mills . . . . . Columbia, S. C. . . . Oct. 18, 1900.
Henry Rowe, ... Mgr. Aurora Bleachery & Dye Works Box 305 . . . . . Aurora, Ill. . . . Apr. 28, 1904.

Alfred Sagar . . . . . Supt. Arlington Cotton Mills . . . . . 15 High St., Methuen, Mass. . . Apr. 24, 1902.
Edward H. Sanborn . . Vice Pres. Cold Spring Bleaching and Finishing Works . . . . . North American Bldg., Philadelphia, Pa. . . Oct. 18, 1900.
J. N. Sanderson . . Agt. Renfrew Mfg. Co., ... Adams, Mass., . . . Apr. 28, 1904.
Arnold B. Sanford . . Pres. Kennebec Spinning Mills . . . . . 67 Chauncy St., Boston, Mass. . . . Oct. 25, 1882.
Pardon B. Sanford . . Supt. Utica Spinning Co. . . . . Utica, N. Y. . . . . Oct. 2, 1902.
J. Herbert Sawyer . . . . . 93 Federal St., Boston, Mass. . . . July 19, 1865.
George H. Sayward . . . . . Winchester, Mass. . Oct. 29, 1890.
Arnold Schaer . . . . Agt. Warren Manufg. Co. . . . . Warren, R. I. . . . Apr. 24, 1895.

Albert E. Schofield	Delph Spinning Co. Clearfield and C Sts., Philadelphia, Pa.	Oct.	1, 1903.
Theodore C. Search	Pres. Cold Spring Bleaching and Finishing Works Yardley, Pa.	Oct.	18, 1900.
Albion K. Searls	Supt. Yarn Dept., Oneita Knitting Mills 241 South St., Utica, N. Y.	Apr.	24, 1902.
Charles M. Sears	Supt. Harmony Grove Cotton Mills . Commerce, Ga.	Apr.	27, 1898.
George H. Shapley	Treas. Silver Lake Co., 78 Chauncy St. Boston, Mass.	Apr.	29, 1896.
Frank P. Sheldon	Mill Engineer and Architect, 49 Westminster St. Industrial Trust Bldg. Providence, R. I.	Apr.	25, 1894.
Thomas C. Sheldon	Agt. Fitchburg Duck Mills 8 School St., Fitchburg, Mass.	Oct.	29, 1884.
Willis S. Shepard	Pres. American Net and Twine Co. . Ponkapoag, Mass.	Apr.	29, 1896.
William F. Sherman	Mill Engineer . . . 294 Washington St., Boston, Mass.	Apr.	15, 1874.
Charles M. Shove	Treas. Granite Mills . . . Box 45, Fall River, Mass.	Oct.	27, 1875.
Herbert H. Shumway	Treas. and Agt. Corr Manufg. Co. . Taunton, Mass.	Apr.	26, 1893.
Francis H. Silsbee	Supt. Cotton Dept. Pacific Mills . . Lawrence, Mass.	Apr.	7, 1887.
Nathaniel G. Simonds	Treas. Naumkeag Steam Cotton Co., Salem, Mass.	Apr.	27, 1898.
Louis Simpson	Victoria Chambers, Ottawa, Ont.	Apr.	24, 1895.
Abbott E. Slade	Treas. Laurel Lake Mills 863 High St., Fall River, Mass.	Oct.	25, 1893.
Arthur T. Smith	Supt. Langley Manufg Co. / Supt. Aiken Manufg. Co. Langley, S. C.	Oct.	25, 1895.
James Herbert Smith	Supt. Quinebaug Co. Danielson, Conn.	Apr.	27, 1898.
Joel Smith	1311 15th St. Augusta, Ga.	Oct.	25, 1895.
J. C. Smith	Supt. Chace Mills Fall River, Mass.	Oct.	28, 1897.
Thomas Henry Smith	Jamestown Cotton Mill Jamestown, N. Y.	Apr.	30, 1884.
Rufus A. Soule	Pres. Soule Mill & City Mfg. Cor. . New Bedford, Mass.	Apr.	28, 1904.
William S. Southworth	Agt. Mass. Cotton Mills . Box 1230, Lowell, Mass.	Oct.	31, 1888.
Wilton H. Spencer	Textile Manuf., . . 7 Exchange Pl., Providence, R. I.	Apr.	27, 1898.
George E. Spofford	Supt. Blackstone Mfg. Co. Blackstone, Mass.	Apr.	29, 1896.
Henry B. Sprague	Treas. Boston Woven Hose and Rubber Co. Lynn, Mass.	Oct.	5, 1899.
Leroy Springs	Pres. Lancaster Cotton Mills . . . Lancaster, S. C.	Oct.	25, 1895.
George R. Stearns	Pres. Riverside Mills Augusta, Ga.	Apr.	30, 1890.
T. B. Stevenson	Supt. Manchang Co. Manchang, Mass.	Apr.	26, 1900.
Robert Stewart	Asst. Supt. Lonsdale Co. Ashton, R. I.	Apr.	27, 1899.
Samuel Stewart	Supt. Boston Duck Co. Bondsville, Mass.	Apr.	23, 1903.
William J. Stewart	Supt. S. Slater & Sons, Inc. Webster, Mass.	Apr.	23, 1903.
Walter F. Stiles	Treas. Orswell Mills Fitchburg, Mass.	Oct.	25, 1895.
O. W. Stites	Elliott Fuel Saving Co. Durham, N. C.	Oct.	25, 1895.
Henry Wm. Stone	Supt. Holliston Mills Norwood, Mass.	Apr.	28, 1904.
B. L. Stowe	Vice-Pres. Eureka Fire Hose Co. Wilkinson and Arlington Aves., Jersey City, N. J.	Sept.	26, 1901.
Herman F. Straw	Agt. Amoskeag Manufg. Co. & Manchester, Mills. Manchester, N. H.	Oct.	28, 1885.

John Sullivan	Supt. Union Cotton Mfg. Co.	Fall River, Mass.	Apr. 27, 1899.
Timothy Sullivan	Supt. Stafford Mills	Fall River, Mass.	Apr. 27, 1899.
Walter H. Summersby	Agt. Atlantic Cotton Mills	Lawrence, Mass.	Oct. 25, 1893.
D. G. Sunderland	Treas. The Pelham Mills	Pelham, S. C.	Oct. 18, 1900.
James O. Sweet	Agt. and Treas. Ashland Cotton Co.	Jewett City, Conn.	Apr. 28, 1886.

Robert Rennie Taft	P. O. Box 1443,	Providence, R. I.	Apr. 24, 1895.
Robert W. Taft	Treas. Coventry Co. and Bernon Mills	Box 1144, Providence, R. I.	Sept. 27, 1894.
George P. Taylor	286 Chestnut St.,	Clinton, Mass.	Oct. 27, 1880.
James W. Taylor	Gen. Mgr. Spinning Dept. Amazon Knitting Co.,	Muskegon, Mich.	Oct. 26, 1892.
Samuel Taylor	Supt. Soule Mill	New Bedford, Mass.	Oct. 1, 1903.
W. Marshall Taylor	Gen. Mgr. National Flax Fibre Co.	Box 327, Millis, Mass.	Sept. 22, 1896.
Richard Thackeray	Supt. Weetamoe Mills	Fall River, Mass.	Apr. 29, 1885.
S. Willard Thayer	Treas. Dexter Yarn Co.	Pawtucket, R. I.	Sept. 26, 1901.
Berton A. Thissell	Supt. Boott Cotton Mills	Lowell, Mass.	Oct. 1, 1903.
Earl A. Thissell	Treas. Lowell Hosiery Co.	Lowell, Mass.	Oct. 30, 1878.
Ariel C. Thomas	Agt. Boott Cotton Mills	62 Mt. Vernon St., Lowell, Mass.	Oct. 31, 1888.
Charles E. Thomas	Treas. Forestdale Manufg. Co.	44 Prospect St., Woonsocket, R. I.	Oct. 31, 1883.
Edward W. Thomas	Gen. Mgr. Richland, Granby & Olympia Mills	Columbia, S. C.	Apr. 30, 1884.
D. M. Thompson	Pres. F. W. Reynolds Co.,	Providence, R. I.	Oct. 28, 1885.
James O. Thompson, Jr.	Supt. Wamsutta Mills	New Bedford, Mass.	Oct. 18, 1900.
Ralph E. Thomson	Supt. Parkhill Manufg. Co., Mill C.	Fitchburg, Mass.	Apr. 25, 1894.
Joseph S. Tidd	Treas. Oakland Mills	Taunton, Mass.	Apr. 27, 1899.
Horace W. Tinkham	Treas. and Agt. Robeson Mills	Fall River, Mass.	Apr. 27, 1899.
R. Irving Tobey	Mgr. Cold Spring Bleaching and Finishing Works	Yardley, Pa.	Oct. 2, 1902.
W. O. Todd	Sec. and Treas. Lawton Spinning Co.	Box 1125, 621 Banigan Building, Providence, R. I.	Oct. 18, 1900.
James P. Tolman	Pres. Samson Cordage Works	115 Congress St., Boston, Mass.	Oct. 29, 1890.
Daniel A. Tompkins	Pres. and Eng. D. A. Tompkins Co.	Charlotte, N. C.	Oct. 25, 1895.
M. J. Toohey	Mfr. Rope, Twine and Banding	809 Stafford Rd., Fall River, Mass	Oct. 2, 1902.
George W. Towne	Mgr. Columbus Power Co.	Columbus, Ga.	Oct. 26, 1892.
Edward B. Townsend,	Treas. Warwick Mills,	27 Kilby St., Boston, Mass.	Apr. 25, 1901.
D. Irving Trainer	Agt. Lincoln Mfg. Co.	Chester, Pa.	Apr. 23, 1903.
Robert B. Treat	Pres. and Treas. Manufacturers Fuel Co. of Rhode Island	1032 Banigan Bldg., Providence, R. I.	Sept. 27, 1894.

C. H. Truesdell	Supt. Attawaugan Co.	Killingly, Conn.	Oct. 29, 1884.
Edmund E. Truesdell	Supt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 26, 1876.
Oscar B. Truesdell	18 Washington Terrace, Newtonville, Mass.		Oct. 15, 1873.
George E. Tucker	Agt. Otis Co.	Ware, Mass.	Oct. 25, 1895.
Philip S. Tuley	Pres. and Treas. Louisville Cotton Mills Co.	1008 Goss Ave., Louisville, Ky.	Oct. 18, 1900.
George W. Turner	Supt. Argo Mills Co.	Gloucester City, N. J.	Apr. 26, 1900.
William D. Twiss	Supt. Everett Mills	Lawrence, Mass.	April 29, 1896.
Charles T. Upton	63 Mt. Vernon St., Lowell, Mass.		Apr. 28, 1897.
George A. Vaughan	Supt. The Putnam Manufg. Co.	Putnam, Conn.	Sept. 22, 1896.
William P. Vaughan	Agt. Putnam Manufacturing Co.	1041 Banigan Building, Providence, R. I.	Sept. 29, 1898.
Frank P. Vogl	Agt. Monadnock Mills	Claremont, N. H.	Sept. 27, 1894.
Jude C. Wadleigh	Supt. Mass. Cotton Mills	Lowell, Mass.	Oct. 26, 1892.
Herbert E. Walmsley	Agt. Wamsutta Mills	New Bedford, Mass.	Oct. 29, 1890.
Robinson Walmsley	Supt. Tecumseh Mills, P. O. Box 246, Fall River, Mass.		Apr. 27, 1899.
Frederick T. Walsh	Mgr. Thomas Leyland & Co., Dyestuffs, etc.	195 Nesmith St., Lowell, Mass.	Apr. 28, 1897.
James A. Walsh	Agt. Lewiston Bleachery and Dye Works	Lewiston, Me.	Apr. 27, 1892.
Joseph Watters	Supt. Osborn Mills	Fall River, Mass.	Oct. 15, 1873.
F. E. Wattles	Agt. Boscawen Mills	Penacook, N. H.	Oct. 5, 1899.
Wm. T. Westerman	Mgr. Ontario Spinning Co.	1729 Philip St., Philadelphia, Pa.	Oct. 1, 1903.
W. B. Smith Whaley	Mechanical & Mill Engineer, Pres. Richland Cotton Mills, Granby Cotton Mills, 1012 Tremont Bldg., Boston, Mass,	1328 Main St., Columbia, S. C.	Apr. 24, 1895.
H. D. Wheat	Pres. and Treas. Gaffney Mfg. Co. and Pres. and Treas. Orient Mfg. Co.	Gaffney, S. C.	Apr. 24, 1895.
Channing Whitaker	Infringement and Patentability of Inventions Lowell Machine Shop	Lowell, Mass.	Oct. 15, 1873.
A. Tenny White	Supt. Manville Co.	Manville, R. I.	Oct. 27, 1887.
Alphonso F. White	Supt. Forestdale Mfg. Co.,	Forestdale, R. I.	Apr. 24, 1902.
Charles D. White	Agt. Uncasville Mfg. Co.	Norwich, Conn.	Oct. 28, 1897.
Arthur F. Whitin	Pres. Saunders Cotton Mills	Whitinsville, Mass.	Apr. 24, 1895.
Fred B. Whitin	Agt. Uxbridge Cotton Mills	Linwood, Mass.	Apr. 28, 1897.
Henry T. Whitin	Treas. Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 25, 1877.
James Earle Whitin	Pres. Uxbridge Cotton Mills	Whitinsville, Mass	Apr. 23, 1903.
Paul Whitin	Asst. Treas. Paul Whitin Mfg. Co.	Northbridge, Mass.	Oct. 1, 1903.
Alfred N. Whiting	Sec. and Treas. L. M. Harris Manufg. Co.	167 Pleasant St., Worcester, Mass.	Apr. 21, 1875.
William Whitman	Pres. Arlington Mills, 78 Chauncey St.	P. O. Box 100, Essex St. Station, Boston, Mass.	Apr. 25, 1901.

William S. Whitney . . Supervising Engineer, American Woolen Co. . . . . Lawrence, Mass. . . Apr. 24, 1878.
Arthur Whittam . . . Pres. and Mgr. John M. Stone Cotton Mills . . . . . Starkville, Miss., . . Apr. 27, 1898.
William Whittam, Jr. . Vice Pres. & Gen. Mgr. The William Whittam Textile Co. . . . . Ashville, N. C. . . . Apr. 26, 1893.
George F. Whitten . . Agt. Amory Mfg. Co. . . . . Manchester, N. H. . Oct. 26, 1892.
John H. Whitten . . . Agt. Stark Mills . . . . . Manchester, N. H. . Apr. 27, 1898.
W. R. B. Whittier . . Mgr. Whittier Mills . . . Chattahoochee, Fulton Co., Ga. . Oct. 18, 1900.
George A. Wies . . . . Treas. Eureka Fire Hose Co. . . . . 13 Barclay St., New York City . . . Apr. 24, 1902.
R. W. Wight, ... Asst. Treas. Indian Orchard Co., . . Indian Orchard, Mass., Apr. 28, 1904.
Edward B. Wilbur . . Gen. Mgr. & Supt. Mollohon Mfg. Co. Newberrry, S. C. . . . Oct. 30, 1889.
Benjamin Wilcox . . . Treas. City Mfg. Co. . . . . New Bedford, Mass. . Apr. 26, 1900.
John B. Wild . . . . Pres. Oneita Knitting Mills . . . . Utica, N. Y. . . . . Apr. 26, 1900.
Eben C. Willey . . . . Mgr. Hope Mills Mfg. Co. . . . . Hope Mills, N. C. . . Apr. 29, 1896.
Franklin D. Williams . Asst. Treas. Hamilton Mfg. Co. . . 70 Kilby St. Room 48 . . . . . Boston, Mass. . . . . Apr. 25, 1901.
Henry Williams . . . Supt. Canoe River Mill . . . . . Taunton, Mass. . . . Apr. 23, 1903.
Broadus E. Willingham, Sec. and Treas. Willingham Cotton Mills . . . . . Macon, Ga. . . . . Oct. 18, 1900.
Elias S. Willis . . . . Supt. Boott Cotton Mills . . . Lowell, Mass. . . . Apr. 23, 1903.
William E. Winchester . Director Mississippi Textile School, Agricultural College, Miss. Apr. 24, 1902.
Samuel F. Winsper . . Supt. City Mfg. Co. . . . . New Bedford, Mass. . Apr. 23, 1903.
George Wood . . . . Pres. and Treas. Millville Manufg. Co. . . . . 626 Chestnut St., Phila., Pa. . . . . Oct. 16, 1872.
John P. Wood . . . . . 521 N. 22d St., Philadelphia, Pa. . . Apr. 28, 1897.
Oscar W. Wood . . . Treas. Germantown Spinning Co. . . . . Germantown, Philadelphia, Pa. . . Oct. 18, 1900.
Wm. I. Woodward . . Agt. Shetucket Co., ... Norwich, Conn. . . Apr. 23, 1903.

Adelbert R. Young . . Supt. Ashland Cotton Co. . . . . Jewett City, Conn. . . Apr. 25, 1894.
James M. Young . . . Mgr. Hamilton Cotton Co. . . . . Hamilton, Ont., Can. Apr. 27, 1899.
Lewis J. Young . . . . Supt. Gault Mills of Montreal Cotton Co. . . . . Lock Box 240, Valleyfield, P. Q., Canada . . . . . Oct. 1, 1903.

ASSOCIATE MEMBERS.

S. B. Alexander, Jr. . . Pres. S. B. Alexander, Jr. Co. . . . Charlotte, N. C. . . . Oct. 18, 1900.
Eugene C. Andres . . Exporter and Importer . . . . . 517 John Hancock Building, Boston, Mass. . . . . Oct. 18, 1900.
Henry B. Ashton . . . Agt. S. A. Felton & Son Co. . . . . Manet Road, Newton Centre, Mass. Apr. 26, 1900.
Henry Ashworth . . . Agt. of Elijah Ashworth, Mfr. of Card Clothing . . . . . 89 Globe Mills Ave., Box 427, Fall River, Mass. . . Apr. 28, 1897.

George R. Babbitt . . . Pres. and Gen. Mgr. American Oil Co. and Pres. and Treas.
. . . . . The Burke Eng. Co., 182 So. Water St., Providence, R. I. . Apr. 24,1895.
D. C. Ball . . . . . 5 Beekman St., New York, N. Y. . . Oct. 25, 1895.
Edwin Barnes . . . . Vice Pres. Wm. Firth Co. . . . . .
. . . . . 67 Equitable Building, Boston, Mass. . . . . Apr. 26, 1900.
George S. Barnum . . Sec. and Treas. The Bigelow Co. . New Haven, Conn. . Apr. 24, 1895.
Colin C. Bell . . . . Vice-Pres. American Vulcanized Fibre Co. . . . . .
. . . . . 12 Pearl St., Boston, Mass. . . . Apr. 29, 1896.
Frank P. Bennett . . . Publisher American Wool and Cotton Reporter . . . . .
. . . . . 530 Atlantic Ave., Boston, Mass. . . . Sept. 22, 1896.
William H. Bent . . . Treas. Mason Machine Works . . . Taunton, Mass. . . . April 29, 1896.
Edward H. Best . . . Woolen Merchant, 224 Purchase St., Boston, Mass. . . Apr. 23, 1903.
Albert Birch . . . . . Birch Bros. Co. . . . . Somerville, Mass. . . . Oct. 2, 1902.
F. H. Bishop . . . . . Gen. Mgr. Universal Winding Co. . . . . .
. . . . . 95 South St., Boston, Mass. . . . . Apr. 26, 1900.
Edmund E. Blake . . Selling Agt. Saco & Pettee Machine Shops . . . . . .
. . . . . Newton Upper Falls, Mass. Oct. 2, 1902.
Arthur T. Bradlee, . . Mem. firm of Harding, Whitman & Co. . . . . .
. . . . . 78 Chauncy St., Boston, Mass. . . . . Apr. 25, 1901.
J. Payson Bradley . . . The Kehew-Bradley Co. . . . . .
. . . . . 24 Purchase St., Boston, Mass. . . . Apr. 24, 1895.
J. Frank Braids . . . . Mgr. Grease & Oil Dept., Charles S. Bush Co. . . . . .
. . . . . Box 20, 212 Weybosset St., Providence, R. I. . . Apr. 28, 1897.
Henry Gordon Brinckerhoff, N. E. Mgr. Green Fuel Economizer Co., Box 2654 . .
. . . . . Room 1053, Exchange Bldg., 53 State St., Boston, Mass. Sept. 22, 1896.
H. Martin Brown . . . Treas. U. S. Bobbin & Shuttle Co. . Providence, R. I. . . Apr. 24, 1895.
George L. Brownell . . Inventor and Builder of Improved Twisting Machinery . .
. . . . . 49 Union St., Station A, Worcester, Mass. . . Apr. 23, 1903.
Percy H. Brundage . . . . . 49 Wall St., New York, N. Y. . . Oct. 5, 1899.
John H. Burghardt . . Page Belting Co. . . . 31 Pearl St., Boston, Mass. . . . Apr. 24, 1895.
Charles B. Burleigh . . Textile Power Dept., General Electric Co. . . . . .
. . . . . 84 State St., Boston, Mass. . . Oct. 1, 1903.
Eugene E. Burnham . . Belt Mfr. . . . . 252 Lowell St., Lawrence, Mass. . . Oct. 25, 1895.
Arthur Cecil Butler, . . Agt. for E. A. Leigh, ... 232 Summer St. Boston, Mass.Apr. 28, 1904.
Harry W. Butterworth . Sec. H. W. Butterworth & Sons . . . . . .
. . . . . York and Cedar Sts., Philadelphia, Pa. . . Oct. 28, 1897.
James Butterworth . Pres. H. W. Butterworth & Sons . . . . . .
. . . . . York and Cedar Sts., Philadelphia, Pa. . . Apr. 24, 1895.

French Campbell . . . Mgr. Yarn Dept., Care of James Freeman Brown Co. . . .
. . . . . Box 132, New York, N. Y. . . Oct. 28, 1897.
Malcolm Campbell . . Gen. Mgr. Woonsocket Machine and Press Co. . . . . .
. . . . . Woonsocket, R. I. . . Apr. 24, 1895.
W. W. Carey . . . . . Mfr. Wood Rim Pulleys and Wood Working Machinery . .
. . . . . 514 Broadway, Lowell, Mass. . . . . Apr. 24, 1895.
Albert C. Case . . . . . 25 Broad St., Room 1213, New York, N. Y. . . Sept. 26, 1901.

J. E. Cheesman . . . . Pres. Cheesman Cotton Gin Co. . . . . 76 William St., New York, N. Y. . . Oct. 5, 1899.
Charles H. Child . . . Treas. Standard Mill Supply Co. . . . . P. O. Box 1426, 39 Exchange Place, Providence, R. I. . . Apr. 24, 1895.
Melvin H. Coffin . . . Selling Agt. Whitin Machine Works Whitinsville, Mass. . Oct. 2, 1902.
C. C. Cowan . . . . . 27 William St., New York, N. Y. . . Oct. 5, 1899.
Thomas G. Cox . . . . Selling Agt. Mason Machine Works . . . . . Box 316, Taunton, Mass. . . . Apr. 24, 1895.
Randolph Crompton . . Mem. firm of Crompton-ThayerLoom Co. . . . . Worcester, Mass. . . Oct. 28, 1897.
C. F. Curwen . . . . Treas. Dinsmore Mfg. Co. . . . . Salem, Mass. . . . . Apr. 27, 1899.
Joseph L. Cushing . . Mfr. of Cotton Conveying Systems, Daniel Cushing & Co., ... Box 885, Lowell, Mass. . . . . Apr. 26, 1900.

Frederick I. Dana . . . Gen. Sales Mgr., The Textile Machinery Finishing Co. . . . . Providence, R. I. . . Apr. 24, 1895.
Daniel J. Danker, . . . Mem. firm of Danker & Marston, Importers of dyestuffs and . . . . . chemicals . . . . 247 Atlantic Ave., Boston, Mass. . Apr. 28, 1904
Charles Henry Davis . C. E., Charles Henry Davis & Partners, ... 25 Broad St., New York, N. Y. . . Apr. 23, 1903.
Hugh De Haven . . Prop. De Haven Mfg. Co. . . . . 50-54 Columbia Heights, Brooklyn, N. Y. . . Apr. 23, 1903.
John O. DeWolf, . . . Mech. Engineer W. B. Smith Whaley & Co. . . . . 1012 Tremont Bldg., Boston, Mass. . . . Apr. 25, 1901.
C. E. W. Dow . . . . Selling Agt. American Moistening Co. . . . . 150 Devonshire St., Boston, Mass. . . . Apr. 24, 1895.
Frederick A. Downes . Pres. Keystone Mutual Fire Insurance Co. . . . . 925 Chestnut St., Philadelphia, Pa. . . Oct. 28, 1897.
W. L. Draper . . . . Mgr. Dodge Mfg. Co. . . . . Atlanta Branch, 507 Prudential Building, Atlanta, Ga. . . . Oct. 18, 1900.

Fred W. Easton, . . . Treas. Easton & Burnham Machine Co., ... 180 Weeden St., Pawtucket, R. I. . . Apr. 25, 1901.
William Dresser Edwards Under Feed Stoker Co. . . . . 430 Board of Trade Bldg. Boston, Mass. Oct. 2, 1902.
G. B. Emmons . . . . Pres. Emmons Loom Harness Co. . . . . May St., Lawrence, Mass. . . Oct. 25, 1895.
John Henry English . English-Greene Co. 26 Fountain St., Providence, R. I. . . Oct. 1, 1903.

D. D. Felton . . . . . Treas. S. A. Felton & Son Co. . . . Manchester, N. H. . Apr. 24, 1895.
John W. Ferguson . . Contractor . . . . . Paterson Nat. Bank Bldg., Paterson, N. J. . . . Apr. 24, 1895.
L. L. Flemming . . . Vice-Pres. and Gen. Mgr. American Cotton Co. . . . . 25 Broad St., Lock Box 240, New York, N. Y. . . Apr. 23, 1903.
J. Herbert Foster . . . Cotton Broker . 10 South Water St., Providence, R. I. . . Apr. 24, 1895.

W. F. Fowler, ... Mgr. Baltimore office Westinghouse Elec. & Mfg. Co. . .
. . . . . 221 North Calvert St. Baltimore, Md. . . . Apr. 28, 1904.
Merrill A. Furbush . . . . . 2015 North 33rd St., Philadelphia, Pa. . . Oct. 28, 1897.
John T. Fyans . . . . Agt. Fyans, Frazer & Blackway Co. . . . . .
. . . . . 411 Beach St., Fall River, Mass. . . Apr. 28, 1897.
H. P. Garland . . . . Treas. Garland Mfg. Co. . . . . Saco, Me. . . . . Oct. 25, 1895.
Royal W. Gates . . . . Josiah Gates & Sons, Belting . . . . . .
. . . . . 367 Market St., Lowell, Mass. . . . Apr. 24, 1895.
Vladimir F. Gnesin . . Sole Agt. of The Great Yaroslavl Mfg. Co. of Moscow, Russia
. . . . . 68 Broad St., New York City . . . Oct. 1, 1903.
Rufus B. Goff . . . . Pres. Standard Mill Supply Co. . . . . .
. . . . . 77 Exchange Pl., Box 714, Providence, R. I. . . Apr. 28, 1897.
Arthur F. Gray . . . . Architect and Mill Engineer . . . . . .
. . . . . 53 State St., Room 509, Boston, Mass. . . . Oct. 18, 1900.
Samuel M. Green, M. E. The American Thread Co. . . . . Holyoke, Mass. . . . Apr. 24, 1902..

A. Walter Harris . . . Treas. A. W. Harris Oil Co. . . . . .
. . . . . Box 758, 326 So. Water St., Providence, R. I. . . Oct. 25, 1895.
Alfred H. Hartley . . Dealer in Oils and Mill Supplies . . . . . .
. . . . . Box 409, Fall River, Mass. . . Oct. 28, 1897.
Charles C. Hedrick . . Mech. Eng. Lowell Machine Shop . Lowell, Mass. . . . Apr. 23, 1903.
Jerome Hill . . . . . Pres. Jerome Hill Cotton Co. . . . . .
. . . . . 334 Front St., Memphis, Tenn. . . . Apr. 29, 1896.
Richard H. Hill . . . Gen. Sales Agt. James Hunter Machine Co. . . . . .
. . . . . 70 Kilby St., Boston, Mass. . . . . Apr. 26, 1900.
Alfred K. Hobbs . . . Rubber, Leather and Mill Supplies . Manchester, N. H. . Oct. 18, 1900.
John Hogg . . . . . Smith, Hogg & Gardiner, 144 Essex St., Boston, Mass. . . . Apr. 27, 1899.
Henry A. Holcomb . . . . . Box 249, New Bedford, Mass. . Oct. 25, 1895.
Henry S. Houghton, Sr., Mfr. Grids and Beaters, 61 Pond St., Woonsocket, R. I. . Apr. 28, 1897.
Lewis T. Houghton . . Mfr. Appliances for Cotton Machinery . . . . . .
. . . . . 997 Main St., Worcester, Mass. . . Sept. 26, 1901.
A. H. Howard . . . . Pres. and Treas. Howard Bros. Mfg. Co. . . . . .
. . . . . P. O. Box 54, Worcester, Mass. . . Sept. 26, 1901.
Frederic W. Howe . . Salesman Crompton & Knowles Loom Works . . . . . .
. . . . . 241 Harris Ave., Box 899, Providence, R. I. . . Apr. 24, 1902.
C. H. Hutchins . . . . Pres. Crompton & Knowles Loom Works . . . . . .
. . . . . Worcester, Mass. . . Oct. 25, 1895.

Charles L. Ireson, . . . Belt Mfr. . . . . .
. . . . . P. O. Box 2052, 148 High St., Boston, Mass. . . . . Apr. 28, 1904.

Daniel Jackson . . . . Cotton Buyer B. B. and R. Knight, . Providence, R. I. . . Apr. 24, 1902.
David Jackson . . . . Gen. Mgr. Jackson Pat. Shell Roll Co., Pawtucket, R. I. . . Apr. 24, 1895.

Lawrence M. Keeler . Whitin Machine Works . . . . . Whitinsville, Mass. . Sept. 26, 1901.
William B. Kehew . . The Kehew-Bradley Co., ...
. . . . . 24 Purchase St., Boston, Mass. . . . Apr. 24, 1895.

James H. Kendall . . Edward Kendall & Sons . . . . . Cambridgeport, Mass., Sept. 29, 1898.
John E. Kendrick . . . Pres. American Supply Co., Box 822, Providence, R. I. . . Oct. 5, 1899.
Frank B. Kenney . . . Mgr. Care of T. C. Entwistle Co. . . . . 297 Market St., Lowell, Mass. . . . Oct. 5, 1899.
Joseph C. King . . . . Ring Traveler . . . 133 Essex St., Boston, Mass. . . . Oct. 1, 1903.

W. C. Langford . . . Salesman, . . . 86 Weybosset St., Providence, R. I. . . Apr. 27, 1899.
Josiah M. Lasell . . . Asst. Treas. Whitin Machine Works, Whitinsville, Mass. . Apr. 24, 1895.
John H. Lawrence . . Top Roll Mfr. . . . . New Bedford, Mass. . Apr. 28, 1904.
Samuel D. Lawton . . Treas. Fall River Machine Co. . . . Fall River, Mass. . . Oct. 18, 1900.
Farnk A. LeValley . . Cotton Broker . . . . . Fall River, Mass. . . Apr. 28, 1904.
John H. Lorimer . . . Builder of Textile Machines . . . . . Ontario and Lawrence Sts., Philadelphia, Pa. . . Oct. 28, 1897.
Sanford E. Loring . . Con. Architect, 341 Delaware St., . Syracuse, N. Y. . . Apr. 24, 1902.
Stephen C. Lowe . . . Agt. John Hetherington & Sons, Ltd., ... 186 Devonshire St., Boston, Mass. . . . Oct. 25, 1895.

Francis E. Macomber . Mill Supplies . . . . 21 Pearl St., Boston, Mass. . . . . Apr. 26, 1900.
D. Edgar Manson . . . Agt. Westinghouse Elec. & Mfg. Co. P. O. Box 3483 . . . 131 State St., Room 716, Boston, Mass. . . Apr. 28, 1904.
John P. Marston . . . Mem. of firm Danker & Marston . . . . . 247 Atlantic Ave., Boston, Mass. . . . . Apr. 28, 1904.
Fay H. Martin . . . . Pres. Textile Machinery Co. . . . . 50 State St., Boston, Mass. . . . . Sept. 26, 1901.
F. H. Maynard . . . . Gen. Bus. Mgr. Gen. Fire Extinguisher Co. . . . . Providence, R. I. . . Apr. 24, 1895.
John McCullough, . . . Cotton Waste Merchant . . . . . New Bedford, Mass. . April 25, 1901.
D. E. McGaw . . . . . 293 Courtland St., Atlanta, Ga. . . . . Oct. 18, 1900.
H. G. McKerrow . . . Textile Machinery Importer . . . . . 31 State St., Boston, Mass. . . . Sept. 22, 1896.
D. K. McLaren . . . . Mfr. of Leather Belting 751 Craig St., Montreal, P. Q., Can. Apr. 26, 1900.
John R. Mitchell . . . Mitchell-Bissell Co. . 38 Murray St., New York City . . . Oct. 18, 1900.
Charles B. Moore . . . Mgr. Knowles Steam Pump Works . . . . . 54 Oliver St., Boston, Mass. . . . . Apr. 26, 1900.

John H. Nelson . . . . Treas. William Firth Co. . . . . 60 Baltimore St., Lynn, Mass. . . . . Apr. 26, 1900.
William R. Noone . . . . . 102 South St., Boston, Mass. . . . Oct. 28, 1897.

Thos. J. O'Keefe . . . Mgr. Charles L. Ireson . . . . . 148 High St., Boston, Mass. . . . . Apr. 28, 1904.
John Oldfield . . . . . Mechanical Engineer . . Beacon St., Everett, Mass. . . . Apr. 28, 1904.

Sidney B. Paine . . . General Electric Co. . . 84 State St., Boston, Mass. . . . Apr. 24, 1895.
William F. Parish, Jr. . Chief, Vacuum Oil Co. (Technical Department) . . .
. . . . . 49 Deansgate, Manchester, England, Apr. 24, 1902.
Arthur Parkinson . . . Selling Agt. Arabol Mfg. Co. . . . . .
. . . . . 13 Gold St., New York, N. Y. . . Apr. 28, 1897.
Stephen Minot Pitman . Sec'y Narragansett Mutual Fire Insurance Co. . . . . .
. . . . . 721 Banigan Bldg., Box 315, Providence, R. I. . . Apr. 24, 1895.
Vladimir P. Polevoy . . . . . 120 Broadway, N. Y. Apr. 28, 1897.
Charles F. Pray . . . . Cloth Broker . . . 72 Leonard St., New York, N. Y. . . Apr. 28, 1904.
Charles A. M. Praray . Chas. A. M. Praray & Co., Architect and Mill Engineer . .
. . . . . 832 and 833 Banigan Building, Providence, R. I. . . Apr. 28, 1897.
Theodore H. Price . . Cotton Dealer . . . . 71 Wall St., New York, N. Y. . . Oct. 2, 1902.

Frank W. Reynolds . . Mem. firm Lockwood Greene & Co. . . . . .
. . . . . 93 Federal St., Boston, Mass. . . . Apr. 28, 1904.
Peleg A. Rhodes . . . Sec. Cotton Mill Mutual Fire Insurance Co. . . . . .
. . . . . Augusta, Ga. . . . . Oct. 5, 1899.
Richard H. Rice . . . Gen. Elec. Co. . . . . Lynn, Mass. . . . . Apr. 24, 1895.
E. R. Richardson . . . Asst. Treas. Howard & Bullough American Machine Co., Ltd.
. . . . . Box 678, Pawtucket, R. I. . . Apr. 26, 1900.
C. E. Roberts . . . . Mgr. Hartford Steam Boiler Inspection & Insurance Co. .
. . . . . 101 Milk St., Room 400, Boston, Mass. . . . Apr. 24, 1895.
George I. Rockwood, . Mechanical Engineer, 62 Summer St., Worcester, Mass. . . Apr. 25, 1901.
John M. Russell . . . . Treas. Crompton & Knowles Loom Works . . . . . .
. . . . . Worcester, Mass. . . Oct. 25, 1895.

William B. Scofield . . Mem. firm of Crompton-Thayer Loom Co. . . . . .
. . . . . Worcester, Mass. . . Apr. 28, 1904.
Dwight Seabury . . . Mill Engineer . . . 12 East Ave., Pawtucket, R. I. . . Apr. 25, 1901.
William N. Shaw . . . Treas. The Lincoln Iron Works and Jackson Architectural
. . . . . Iron Works . . 315 E. 28th St., New York, N. Y. . . Apr. 24, 1902.
J. A. Shepherd . . . . Sales Agt. The Stirling Co. . . . . .
. . . . . Germania Building, Pittsburg, Pa. . . . Oct. 18, 1900.
Lewis T. Shurtleff . . . Manager Paper Department, Pairpont Corporation, . . .
. . . . . New Bedford, Mass. Apr. 28, 1904.
Harry M. Smith . . . Vice-Pres. Standard Mill Supply Co. . . . . .
. . . . . 77 Exchange Pl., Box 714, Providence, R. I. . . Apr. 28, 1897.
R. Paul Snelling . . . Treas. Saco and Pettee Machine Shops . . . . . .
. . . . . Newton Upper Falls, Mass. . Sept. 22, 1896.
Henry C. Spence . . . Gen. Mgr. Metallic Drawing Roll Co. Indian Orchard, Mass. Apr. 24, 1895.
George W. Stafford . . Gen. Mgr. The Geo. W. Stafford Co. Readville, Mass. . . Apr. 24, 1895.
H. E. Stafford . . . . Agt. The Geo. W. Stafford Co. . . Readville, Mass. . . Oct. 18, 1900.
James Strang . . . . Selling Agt. Metallic Drawing Roll Co. . . . . .
. . . . . 123 Hampden St., Indian Orchard, Mass. Oct. 28, 1897.

Daniel J. Sully . . . . Cotton Broker, T. M. Reynolds & Co., ... 34 South Water St., Providence, R. I. . . Apr. 24, 1895.
John Sykes, J. P. . . . Pres. English Card Clothing Co. . . . . Acre House, Huddersfield, Eng. . Oct. 18, 1900.

Cyrus A. Taft . . . . Agt. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.
Charles F. Taylor . . . Prop. Burgess Cop Tube Co., ... 15 Custom House St., Providence, R. I. . . Apr. 27, 1898.
Elwood E. Taylor . . . N. E. Mgr. Under-Feed Stoker Co. . . . . 430 Board of Trade Building, Boston, Mass. . . . Apr. 23, 1903.
Robert Taylor, Jr. . . Mgr. Asa Lees & Co. Ltd. . . . . Oldham, England . . Apr. 28, 1904.
George C. Tewksbury . N. E. Mgr. The Under-Feed Stoker Co. of America . . . . . 429-430 Board of Trade Bldg., 131 State St., Boston, Mass. . Apr. 24, 1902.
James T. Thornton . . Treas. Thornton Machinery Co. . . Providence, R. I. . . Oct. 18, 1900.
William V. Threlfall . . Agt. Saco and Pettee Machine Shops, Biddeford, Me. . . . Apr. 24, 1895.
Rienzi W. Thurston . Machinery Manufacturer . . . . . Fall River, Mass. . . Oct. 18, 1900.
H. A. Tillinghast, . . . Treas. The Textile Finishing Mach. Co. . . . . Providence, R. I. . . Apr. 25, 1901.
A. Curtis Tingley . . . Treas. National Ring Traveler Co. . . . . 257 West Exchange St., Providence, R. I. . . Sept. 22, 1896.
Allison W. Trafford . . Mfr. of Ring Travelers . . . . . 116 Pocasset St., Fall River, Mass. . . Apr. 26, 1900.

Frank H. Underwood . Resident Mgr. Dodge Mfg. Co. . . . . 137 Purchase St., Boston, Mass. . . . Apr. 29, 1896.

Clement A. Wakefield . Selling Agt. Saco & Pettee Machine Shops, ... 38 South St., Biddeford, Me. . . . Apr. 25, 1901.
Justin A. Ware . . . . . Spring Hill, Barnstable County, Mass. Oct. 25, 1895.
J. F. Warren . . . . . Treas. J. F. & W. H. Warren Co. . . . . 44 Vine St., Worcester, Mass. . . Apr. 24, 1902.
Lettice R. Washburn . Mill Contractor, 235 North Water St., New Bedford, Mass. . Oct. 5, 1899.
George H. Watson . Pres. The Northern Engineering Co. . . . . 95 Liberty St., New York, N. Y. . . Apr. 23, 1903.
Walter S. Watson . . . Haworth & Watson, Mfrs. Paper Tubes for Textile Manufg. . . . . Box 996, Lowell, Mass. . . . Oct. 25, 1895.
Robert C. Webster . . Mgr. Barber & Colman . . . . . 11 Pemberton Sq., Rooms 1111-12, Boston, Mass. . . . Apr. 24, 1902.
Stephen M. Weld, . . Stephen M. Weld & Co., 89 State St., Boston, Mass. . . . Apr. 27, 1899.
William R. West . . . Roll Coverer . . 830 Purchase St., New Bedford, Mass. . Sept. 22, 1896.
W. W. White . . . . Agent Holyoke Machine Co. . . . Worcester, Mass. . . Apr. 27, 1899.
G. Marston Whitin . . Treas. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.

Fred A. Wilde . . . . Gen. Mgr. The A. T. Atherton Machine Co. . . . . Prairie Ave., Pawtucket, R. I. . . Apr. 28, 1897.

Erving Yale Woolley . Stoddard, Haserick, Richards & Co. . . . . 152 Congress St., Boston, Mass. . . . . Apr. 24, 1895.

Honorary Members	3
Life Members	3
Active Members	575
Associate Members	163
Total Membership	744

MEMBERS OF THE ASSOCIATION,

May 1, 1904.

ARRANGED BY STATES.

MAINE.

Auburn	William Hayes	Barker Mill.
Augusta	Horace P. Carter	Edwards Mfg. Co.
Biddeford	Robert McArthur	Pepperell Mfg. Co.
Biddeford	William V. Threlfall	Saco & Pettee Machine Shops.
Biddeford	Clement A. Wakefield	Saco & Pettee Machine Shops.
Brunswick	Russell W. Eaton	Cabot Manufg. Co.
Kennebunk	Robert W. Lord	R. W. Lord & Co.
Lewiston	George W. Bean	Androscoggin Mills.
Lewiston	H. B. Estes	Continental Mills.
Lewiston	William D. Pennell	Hill Manufg. Co.
Lewiston	Herbert L. Pratt	Bates Manufg. Co.
Lewiston	James A. Walsh	Lewiston Bleachery and Dye Works
Lisbon	W. H. Miles	
Portland	Lyman M. Cousens	Dana Warp Mills.
Saco	H. P. Garland	Garland Mfg. Co.
Saco	James G. Garland	Garland Mfg. Co.
Saco	Elmer E. Page	York Manufg. Co.
Westbrook	Philip Dana	Dana Warp Mills.
Westbrook	Woodbury K. Dana	Dana Warp Mills.

NEW HAMPSHIRE.

Charlestown	Samuel Webber	Hydraulic Engineer.
Claremont	Frank P. Vogl	Monadnock Mills.
Dover	Charles H. Fish	Cocheco Manufg. Co.
Dover	Herbert W. Owen	Cocheco Manufg. Co.
Exeter	Chester D. Hatch	Exeter Mfg. Co.
Exeter	George E. Kent	Exeter Manufg. Co.

Exeter	Hervey Kent	Exeter Manufg. Co.
Greenville	Frederick W. Ely	Columbian Manufg. Co.
Hooksett	Stephen N. Bourne	Dundee Mills.
Manchester	Henry Deane Bourne	Hooksett Manufg. Co.
Manchester	D. D. Felton	S. A. Felton & Son Co.
Manchester	Alfred K. Hobbs	Rubber, Leather and Mill Supplies
Manchester	Elliott Cowdin Lambert	Amoskeag Manufg. Co.
Manchester	Charles H. Manning	Amoskeag Manufg. Co.
Manchester	Herman F. Straw	Amoskeag Manufg. Co. & Manchester Mills.
Manchester	George F. Whitten	Amory Manufg. Co.
Manchester	John H. Whitten	Stark Mills.
Milford	M. F. Foster	
Nashua	William F. Arthur	Nashua Manufacturing Co.
Nashua	William H. Cadwell	Jackson Co.
Nashua	Roscoe S. Milliken	Nashua Mfg. Co.
Penacook	Marcellus Gould	N. H. Spinning Mills.
Penacook	F. E. Wattles	Boscawen Mills.
Peterboro	Albert W. Noone	Jos. Noone's Son's Co.
Pittsfield	William P. Adams	Pittsfield Mills.
Somersworth	Charles H. Plummer	Great Falls Manufg. Co. Salmon Falls Manufg. Co.
Suncook	David L. Jewell	China, Webster & Pembroke Mills.
Suncook	Edmund E. Truesdell	China, Webster & Pembroke Mills.

VERMONT.

North Pownal	Thomas Armstrong	North Pownal Manufg. Co.

MASSACHUSETTS.

Adams	John S. Adams, Jr.	Adams Bros. Manufg. Co.
Adams	Z. D. Hall	Berkshire Cotton Manufg. Co.
Adams	Emil Kipper	Windsor Print Works.
Adams	William B. Orr	Renfrew Mfg Co.
Adams	Charles T. Plunkett	Berkshire Cotton Manufg. Co.
Adams	William C. Plunkett,	W. C. Plunkett & Sons.
Adams	L. B. Renfrew	Renfrew Mfg. Co.
Adams	J. N. Sanderson	Renfrew Mfg. Co.
Amesbury	M. W. Quinn	Hamilton Woolen Co.
Andover	John W. Bell	Smith & Dove Manufg. Co.
Belmont	John Kilburn	
Blackstone	George E. Spofford	Blackstone Manufg. Co.
Bondsville	Elmer G. Childs	Boston Duck Co.
Bondsville	Samuel Stewart	Boston Duck Co.
Boston	Charles B. Amory	Hamilton Mfg. Co.
Boston	Frederic Amory	Nashua Mfg.Co. and Jackson Mfg.Co.

Boston	Eugene C. Andres	517 John Hancock Building.
Boston	Edward Atkinson	Boston Mfrs. Mut. Fire Ins. Co.
Boston	E. W. Atkinson	Stoddard, Haserick, Richards & Co.
Boston	Nathaniel F. Ayer	10 P. O. Square.
Boston	Edwin Barnes	Wm. Firth Co.
Boston	Colin C. Bell	American Vulcanized Fibre Co.
Boston	Albert Farewell Bemis	Jackson Fibre Co.
Boston	Frank P. Bennett	Am. Wool and Cotton Reporter.
Boston	Edward H. Best	Woolen Merchant.
Boston	F. H. Bishop	Universal Winding Co.
Boston	Arthur T. Bradlee	Harding, Whitman & Co.
Boston	J. Payson Bradley	The Kehew-Bradley Co.
Boston	S. Parker Bremer	Monadnock Mills.
Boston	Henry Gordon Brinckerhoff	Green Fuel Economizer Co.
Boston	John H. Burghardt	Page Belting Co.
Boston	Charles B. Burleigh	General Electric Co.
Boston	Arthur Cecil Butler	232 Summer St.
Boston	Frank B. Comins	American Moistening Co.
Boston	Alphonse S. Covel	Tremont and Suffolk Mills.
Boston	Daniel J. Danker	Danker & Marston.
Boston	Augustus De Cort	Beacon Mfg. Co.
Boston	P. Y. DeNormandie	Pepperell Mfg. Co.
Boston	John O. DeWolf	W. B. Smith Whaley & Co.
Boston	C. E. W. Dow	150 Devonshire St.
Boston	Frederic C. Dumaine	Amory Mfg. Co.
Boston	Wm. Dresser Edwards	Under Feed Stoker Co.
Boston	William Firth	Am. Moist. Co. and Wm. Firth Co.
Boston	Alfred M. Goodale	Boston Mfg. Co.
Boston	Arthur F. Gray	53 State St., Room 509.
Boston	Edwin Farnham Greene	Lockwood, Greene & Co. and Dwight Mfg. Co.
Boston	Richard H. Hill	Jas. Hunter Machine Co.
Boston	William H. Hill	Renfrew Mfg. Co.
Boston	Franklin W. Hobbs	Arlington Mills.
Boston	John Hogg	Smith, Hogg & Gardiner.
Boston	Henry S. Howe	Dry Goods Commission.
Boston	Charles W. Hubbard	Ludlow Mfg. Associates.
Boston	Otis L. Humphry	78 Chauncy St.
Boston	Charles L. Ireson	Belt Mfr.
Boston	William B. Kehew	The Kehew-Bradley Co.
Boston	Joseph C. King	Morley Button Mfg. Co.
Boston	Evan Arthur Leigh	232 Summer St.
Boston	William C. Lovering	Whittenton Mfg. Co.
Boston	Stephen C. Lowe	John Hetherington & Sons, Ltd.
Boston	A. Lawrence Lowell	53 State St.
Boston	Herbert Lyman	39 Beacon St.
Boston	Ronald T. Lyman	Boston Mfg. Co.

Boston	Francis E. Macomber	21 Pearl St.
Boston	Charles T. Main	Dean & Main.
Boston	D. Edgar Manson	Westinghouse Elec. & Mfg. Co.
Boston	John P. Marston	Danker & Marston.
Boston	Fay H. Martin	Textile Machinery Co.
Boston	Fred C. McDuffie	Everett Mills and York Mfg. Co.
Boston	H. G. McKerrow	31 State St.
Boston	Charles B. Moore	Knowles Steam Pump Works.
Boston	George B. Morison	Ballou Yarn Co.
Boston	Robert W. Neff	Chemical Mfr.
Boston	William R. Noone	102 South St.
Boston	Thomas J. O'Keefe	148 High St.
Boston	Sidney B. Paine	General Electric Co.
Boston	Benjamin Phipps	4 Winthrop Sq.
Boston	, Henry Smith Pritchett, LL.D.	Mass. Institute of Technology.
Boston	Frank W. Reynolds	Lockwood Greene & Co.
Boston	Charles E. Riley	C. E. Riley & Co.
Boston	C. E. Roberts	Hartford Steam Boiler Insp. & Ins.Co
Boston	Arnold B. Sanford	Kennebec Spinning Mills.
Boston	J. Herbert Sawyer	93 Federal St.
Boston	George H. Shapley	Silver Lake Co.
Boston	William F. Sherman	294 Washington St.
Boston	Elwood E. Taylor	Under-Feed Stoker Co.
Boston	George C. Tewksbury	The Under-Feed Stoker Co. of America.
Boston	James P. Tolman	Samson Cordage Works.
Boston	Edward B. Townsend	Warwick Mills.
Boston	Frank H. Underwood	Dodge Mfg. Co.
Boston	Robert C. Webster	Barber & Colman.
Boston	Stephen M. Weld	89 State St.
Boston	William Whitman	Arlington Mills.
Boston	Franklin D. Williams	Hamilton Mfg. Co.
Boston	Erving Yale Woolley	Stoddard Haserick, Richards & Co.
Cambridgeport	James H. Kendall	Edward Kendall & Sons.
Chicopee	O. D. Drew	Dwight Mfg. Co.
Chicopee Falls	G. H. T. Babbitt	Chicopee Mfg. Co.
Clinton	William G. McLoon	Lancaster Mills.
Clinton	Charles H. Richardson	Lancaster Mills.
Clinton	George P. Taylor	286 Chestnut St.
East Dedham	Benjamin M. Earl	Merchant Dye Works.
Easthampton	George A. Ayer	West Boylston Co.
Everett	John Oldfield	Beacon St.
Fall River	F. S. Akin	Cornell Mills.
Fall River	Henry Ashworth	Agt. for Card Clothing Manufr.
Fall River	J. W. Bailey	Principal, The Bradford Durfee Textile School.
Fall River	John P. Bodge	Arkwright Mills.

Fall River	Jefferson Borden, Jr.	Fall River Bleachery Co.
Fall River	Nathaniel B. Borden	Barnard Manufg. Co.
Fall River	Richard B. Borden	Richard Borden Mfg. Co.
Fall River	James T. Broadbent	Bradford Durfee Textile School.
Fall River	Isaac A. Brown	Narragansett Mills.
Fall River	John L. Burton	1,042 Plymouth Ave.
Fall River	George A. Chace	Bourne Mills.
Fall River	Simeon B. Chase	King Philip Mills.
Fall River	John A. Collins	American Linen Co.
Fall River	Bradford D. Davol	Barnard Manufg. Co.
Fall River	Frank H. Dwelly	Tecumseh Mills.
Fall River	David H. Dyer	D. H. Dyer & Son.
Fall River	John H. Estes	Cotton Manufacturer.
Fall River	William Evans	Wampanoag Mills.
Fall River	Charles F. Farrar	49½ Coggeshall St..
Fall River	John T. Fyans	Fyans, Frazer & Blackway Co.
Fall River	Arthur M. Hamilton	Hargraves and Parker Mills.
Fall River	John F. Hamlet	P. O. Box 160
Fall River	Alfred H. Hartley	Oils and Mill Supplies.
Fall River	Samuel E. Hathaway	Fall River Iron Works Co.
Fall River	William Hathaway	Barnard Mfg. Co.
Fall River	William B. Hawes	Yarn Broker.
Fall River	George H. Hills	Davol Mills and Stevens Mfg. Co.
Fall River	William P. Holt	Barnaby Mills.
Fall River	Leonard Johnson	Wampanoag Mills.
Fall River	George H. Law	Merchants' Mfg. Co.
Fall River	Samuel D. Lawton	Fall River Machine Co.
Fall River	Frank A. Le Valley	Cotton Broker.
Fall River	Leontine Lincoln	Seaconnet Mills.
Fall River	Alexander Makepeace	Richard Borden Mfg. Co.
Fall River	Henry D. Martin	Stevens Mfg. Co.
Fall River	Arthur H. Mason	Barnaby Mfg. Co.
Fall River	Philip A. Mathewson	King Philip Mills.
Fall River	Thomas McAuliffe	Stevens Manufg. Co.
Fall River	James A. McLane	Davis Mills.
Fall River	J. Edward Osborn	American Linen Co.
Fall River	Joseph H. Potter, Jr.	Durfee Mills.
Fall River	John Bion Richards	Davis Mills.
Fall River	Harry J. Ricketson	Merchants' Mfg. Co.
Fall River	Benj. H. Roberts	163 Grove St.
Fall River	Charles M. Shove	Granite Mills.
Fall River	Abbott E. Slade	Laurel Lake Mills.
Fall River	J. C. Smith	Chace Mills.
Fall River	John Sullivan	Union Cotton Manufg. Co.
Fall River	Timothy Sullivan	Stafford Mills.
Fall River	Richard Thackeray	Weetamoe Mills.
Fall River	Rienzi W. Thurston	Machinery Manufacturer.

Fall River	Horace W. Tinkham	Robeson Mills.
Fall River	M. J. Toohey	Mfr. Rope, Twine and Banding.
Fall River	Allison W. Trafford	Mfr. Ring Travelers.
Fall River	Robinson Walmsley	Tecumseh Mills.
Fall River	Joseph Watters	Osborn Mills.
Fisherville	Albert W. Dimick	Fisher Mfg. Co.
Fisherville	Charles W. Fisher	Fisher Mfg. Co.
Fiskdale	John Gregson	Fiskdale Mills.
Fitchburg	Ernest L. Hersom	Nockege Mill.
Fitchburg	George P. Grant, Jr.	Grant Yarn Co.
Fitchburg	W. E. Keach	Grant Yarn Co.
Fitchburg	Arthur H. Lowe	Parkhill Manufg Co.
Fitchburg	David Lowe	Parkhill Manufg. Co.
Fitchburg	Thomas C. Sheldon	Fitchburg Duck Mills.
Fitchburg	Walter F. Stiles	Orswell Mills.
Fitchburg	Ralph E. Thomson	Parkhill Manufg. Co., Mill C.
Holyoke	Samuel M. Green	The American Thread Co.
Holyoke	Ernest Lovering	Lyman Mills.
Hopedale	Eben S. Draper	Draper Co.
Hopedale	George A. Draper	Draper Co.
Hopedale	George Otis Draper	Draper Co.
Hopedale	William F. Draper	Draper Co.
Hopedale	Frank J. Dutcher	Draper Co.
Housatonic	Jno. H. C. Church	Monument Mills.
Housatonic	Theodore Ellis Ramsdell	Monument Mills.
Hyde Park	Calvin H. Lee	Readville Cotton Mills.
Indian Orchard	William C. Godfrey	Indian Orchard Co.
Indian Orchard	Henry C. Spence	Metallic Drawing Roll Co.
Indian Orchard	James Strang	Metallic Drawing Roll Co.
Indian Orchard	R. W. Wight	Indian Orchard Co.
Ipswich	James W. Brown	Box 312.
Lawrence	James W. Ahmuty	Atlantic Cotton Mills.
Lawrence	William A. Barrell	Lawrence Duck Co.
Lawrence	Joseph P. Battles	Joseph Battles Co.
Lawrence	Albert W. Brainard	Box 33.
Lawrence	Eugene E. Burnham	252 Lowell St.
Lawrence	G. B. Emmons	Emmons Loom Harness Co.
Lawrence	William D. Hartshorne	Arlington Mills.
Lawrence	Walter M. Hastings	Arlington Mills.
Lawrence	John T. Lord	Pacific Mills.
Lawrence	James I. Milliken	Everett Mills.
Lawrence	Walter E. Parker	Pacific Mills.
Lawrence	Robert Redford	Box 28.
Lawrence	Francis H. Silsbee	Pacific Mills.
Lawrence	Walter H. Summersby	Atlantic Cotton Mills.
Lawrence	William D. Twiss	Everett Mills.
Lawrence	William S. Whitney	American Woolen Co.

Leicester	Charles A. Denny	
Linwood	Amos G. Maddox	Linwood Mill.
Linwood	Fred B. Whitin	
Lowell	George E. Ames	Lawrence Manufg. Co.
Lowell	Frank A. Bowen	Appleton Co.
Lowell	Edward N. Burke	Lowell Machine Shop.
Lowell	W. W. Carey	Wood Rim Pulleys and Wood Working Machinery.
Lowell	Alfred M. Chadwick	Tremont and Suffolk Mills.
Lowell	Clarence N. Childs	Hamilton Mfg. Co.
Lowell	Daniel Clark	16 Fifth Ave.
Lowell	John J. Connell	Tremont and Suffolk Mills.
Lowell	A. G. Cumnock	Appleton Co.
Lowell	Joseph L. Cushing	Daniel Cushing & Co.
Lowell	Albert W. Danforth	Shanghai Cotton Cloth Mills.
Lowell	Edward P. Dennis	
Lowell	John H. Dunn	Tremont & Suffolk Mills.
Lowell	William Ambrose Eastman	Hooper Knitting Co.
Lowell	Royal W. Gates	Josiah Gates & Sons.
Lowell	William E. Hall	Shaw Stocking Co.
Lowell	Charles C. Hedrick	Lowell Machine Shop.
Lowell	Artuhur N. Hersom	Tremont & Suffolk Mills.
Lowell	A. W. Hunking,	374 Stevens St.
Lowell	Frank B. Kenney	T. C. Entwistle Co.
Lowell	Charles F. Libby	Shaw Stocking Co.
Lowell	Alvin S. Lyon	Bigelow Co.
Lowell	Albert H. Morton	Kitson Machine Co.
Lowell	Oliver H. Moulton	Hamilton Manufg. Co.
Lowell	Will Nelson	Lowell Textile School.
Lowell	Franklin Nourse	Lawrence Manufg. Co.
Lowell	John W. Pead	Merrimack Manufg. Co.
Lowell	Haven C. Perham	Kitson Machine Co.
Lowell	M. A. Rawlinson	38 Butterfield St.
Lowell	William S. Southworth	Mass. Cotton Mills.
Lowell	Berton A. Thissell	Boott Cotton Mills.
Lowell	Earl A. Thissell	Lowell Hosiery Co.
Lowell	Ariel C. Thomas	Boott Cotton Mills.
Lowell	Charles T. Upton	63 Mt. Vernon St.
Lowell	Jude C. Wadleigh	Mass. Cotton Mills.
Lowell	Frederick T. Walsh	Thomas Leyland & Co.
Lowell	Walter S. Watson	Haworth & Watson.
Lowell	Channing Whitaker	Lowell Machine Shop.
Lowell	Elias S. Willis	Boott Cotton Mills.
Lynn	John H. Nelson	Wm. Firth Co.
Lynn	Richard H. Rice	Gen. Elec. Co.
Lynn	Henry B. Sprague	Boston Woven Hose and Rubber Co.
Lynn	C. J. H. Woodbury	51 Baltimore St.

Manchang	T. B. Stevenson	Manchang Co.
Methuen	Lewis E. Barnes	Pemberton Co. and Methuen Co.
Methuen	Alfred Sagar	Arlington Cotton Mills.
Millbury	Fred W. Moore	Cordis Mills.
Millbury	Francis H. Rice	Holbrook Mfg. Co.
Millis	W. Marshall Taylor	National Flax Fibre Co.
New Bedford	Christopher P. Brooks	International Correspondence School
New Bedford	Richard Cowell	290 Summer St.
New Bedford	William W. Crapo	Wamsutta Mills.
New Bedford	Mark B. Creed	Wamsutta Mills.
New Bedford	Frederick Grinnell	Gen. Fire Extinguisher Co.
New Bedford	Hiram Higham	Wamsutta Mills.
New Bedford	Henry A. Holcomb	Box 249.
New Bedford	Charles M. Homes	Box 96.
New Bedford	Nathaniel B. Kerr	Butler Mill.
New Bedford	Walter H. Langshaw	Dartmouth Manufg. Corp.
New Bedford	John H. Lawrence	Top Roll Mfg.
New Bedford	Frederick B. Macy	Soule Mills.
New Bedford	John McCullough	Cotton Waste Merchant.
New Bedford	John Neild	Grinnell Mfg. Corp.
New Bedford	Walter H Paige	Wamsutta Mills.
New Bedford	Albert R. Pierce	Pierce Mfg. Corp.
New Bedford	Andrew G. Pierce, Jr.	Pierce Mfg. Corp.
New Bedford	Lavater W. Powers	141 Merrimac St.
New Bedford	Frederick W. Reynolds	Potomska Mills.
New Bedford	Lewis T. Shurtleff	Pairpoint Corp.
New Bedford	Rufus A Soule	Soule Mills.
New Bedford	Samuel Taylor	Soule Mill.
New Bedford	James O. Thompson, Jr.	Wamsutta Mills.
New Bedford	Herbert E. Walmsley	Wamsutta Mills.
New Bedford	Lettice R. Washburn	235 North Water St.
New Bedford	William R. West	830 Purchase St.
New Bedford	Benjamin Wilcox	City Mfg. Co.
New Bedford	Samuel F. Winsper	City Mfg Co.
Newton	Josiah G. Coburn	99 Washington St.
Newton Centre	Henry B. Ashton	S. A. Felton & Son Co.
Newtonville	Oscar B. Truesdell	18 Washington Terrace.
Newton Upper Falls	Edmund E. Blake	Saco & Pettee Machine Shops.
Newton Upper Falls	Frank J. Hale	Saco and Pettee Machine Shops.
Newton Upper Falls	R. Paul Snelling	Saco and Pettee Machine Shops.
North Adams	Hervey Burnham	Beaver Mills and Eclipse Mill.
Northbridge	Henry S. Houghton, Jr.	Paul Whitin Manufg. Co.
Northbridge	Henry T. Whitin	Paul Whitin Manufg. Co.
Northbridge	Paul Whitin	Paul Whitin Mfg. Co.
Northampton	Charles E. Childs,	West Boylston Co.
North Oxford	Edwin N. Bartlett	Sigourney and Rockdale Mills.
North Plymouth	Gideon F. Holmes	Plymouth Cordage Co.

Norwood	Henry William Stone	Holliston Mills.
Ponkapoag	Willis S. Shepard	American Net & Twine Co.
Readville	George W. Stafford	The George W. Stafford Co.
Readville	H. E. Stafford	The George W. Stafford Co.
Salem	C. F. Curwen	Dinsmore Mfg. Co.
Salem	William P. McMullan	Naumkeag Steam Cotton Co.
Salem	Henry Osgood	P. O. Box 204.
Salem	Nathaniel G. Simonds	Naumkeag Steam Cotton Co.
Shattuckville	Frank S. Field	Massaemit Yarn Mills.
Somerville	Albert Birch	Birch Bros. Co.
South Hadley Falls	Charles W. Dennett	So. Hadley Mills.
Springfield	Joseph M. Dunham	43 Edwards St.
Spring Hill	Justin A. Ware	
Taunton	A. C. Bent	Safety Seamless Pocket Co.
Taunton	William H. Bent	Mason Machine Works.
Taunton	Peter H. Corr	Greenwich Bleachery.
Taunton	Thomas G. Cox	Mason Machine Works.
Taunton	H. H. Culver	Elizabeth Poole Mills.
Taunton	Henry S. Culver	Westville Cotton Mills.
Taunton	Andrew J. Currier	New England Cotton Yarn Co.
Taunton	Eugene Finocchiaro	Cohannet Mills.
Taunton	Jesse A. Knight	Cohannet Mills.
Taunton	Henry M. Lovering	Whittenton Manufg. Co.
Taunton	Charles L. Macomber	Winthrop Cotton Yarn Co.
Taunton	John Tempest Meats	Mason Machine Works.
Taunton	Herbert H. Shumway	Corr Manufg. Co.
Taunton	Joseph S. Tidd	Oakland Mills.
Taunton	Henry Williams	Canoe River Mill.
Thorndike	Charles H. Hobbs	Thorndike Co.
Three Rivers	Roscius C. Newell	Palmer Mill.
Turners Falls	Samuel L. Parker	Turners Falls Cotton Mills.
Waltham	Charles E. Getchell	Waltham Emery Wheel. Co
Waltham	Arthur H. Gulliver	Boston Mfg. Co.
Ware	George E. Tucker	The Otis Co.
Webster	E. P. Morton	Stevens Linen Works.
Webster	William J. Stewart	S. Slater & Sons Inc.
West Warren	A. G. Harris	West Warren Cotton Mills.
West Warren	George A. Moody	West Warren Cotton Mills.
Whitinsville	Alfred E. Adams	Whitinsville Cotton Mills and Linwood Mills.
Whitinsville	Melvin H. Coffin	Whitin Machine Works.
Whitinsville	Lawrence M. Keeler	Whitin Machine Works.
Whitinsville	Josiah M. Lasell	Whitin Machine Works.
Whitinsville	Oscar L. Owen	Whitin Machine Works.
Whitinsville	Cyrus A. Taft	Whitin Machine Works.
Whitinsville	Arthur F. Whitin	Saunders Cotton Mills.
Whitinsville	G. Marston Whitin	Whitin Machine Works.

Whitinsville	James Earle Whitin	Uxbridge Cotton Mills.
Williamstown Sta.	Roland R. Kelly	Williamstown Manufg. Co.
Winchester	George H. Sayward	
Worcester	George L. Brownell	Inventor and Builder of Improved Twisting Machinery.
Worcester	George Crompton	Crompton-Thayer Loom Co.
Worcester	Randolph Crompton	Crompton-Thayer Loom Co.
Worcester	Henry F. Harris	W. Boylston Mfg. Co.
Worcester	Lewis T. Houghton	997 Main St.
Worcester	A. H. Howard	Howard Bros. Mfg. Co.
Worcester	C. H. Hutchins	Crompton & Knowles Loom Works.
Worcester	Geo. E. Prest	104 Harrison St.
Worcester	Harry B. Prest	340 Highland St.
Worcester	John E. Prest	340 Highland St.
Worcester	Geo. I. Rockwood	62 Summer St.
Worcester	John M. Russell	Crompton & Knowles Loom Works.
Worcester	Wm. B. Scofield	Crompton-Thayer Loom Lo.
Worcester	J. F. Warren	J. F. & W. H. Warren Co.
Worcester	W. W. White	Holyoke Machine Co.
Worcester	Alfred N. Whiting	L. M. Harris Mfg. Co.

RHODE ISLAND.

Allenton	R. A. Gray	Rodman Manufg. Co.
Ashton	Charles H. Collins	Berkeley Co.
Ashton	Robert Stewart	Lonsdale Co.
Central Falls	Louis B. Barker	United States Cotton Co.
Central Falls	David Grove	United States Cotton Co.
Central Falls,	B. F. G. Linnell,	Yarns, Threads and Twines.
Centreville	James T. Ferguson	Warwick Mills.
Crompton	Charles D. Robinson	Crompton Co.
Fiskville	James Gee	Interlaken Dye Works.
Forestdale	Alphonso F. White	Forestdale Mfg. Co.
Georgiaville	A. E. Bosworth	Bernon Mills.
Longmeadow	Abel T. Atherton	Machine Maker.
Lonsdale	Edward A. Mongeon	Lonsdale Mills.
Manville	A. Tenny White	Manville Co.
Natick	Andrew W. McAllister	Natick Mills.
Pawtucket	V. T. Barber	Slater Cotton Co.
Pawtucket	William Washington Blades,	Lorraine Mfg. Co.
Pawtucket	E. R. Bullock	J. & P. Coats, Ltd.
Pawtucket	Robert Burgess	Slater Cotton Co.
Pawtucket	William P. Dempsey	Dempsey Bleachery & Dye Works.
Pawtucket	Henry C. Dexter	Greene & Daniels Mfg. Co.
Pawtucket	Fred W. Easton	Easton & Burnham Machine Co.
Pawtucket	D. A. Everly	Cotton Mfr.

Pawtucket	David Jackson	Jackson Pat. Shell Roll Co.
Pawtucket	J. B. Jenckes	The E. Jenckes Manufg. Co.
Pawtucket	James R. MacColl	Lorraine Manufg. Co.
Pawtucket	E. R. Richardson	Howard & Bullough American Machine Co., Ltd.
Pawtucket	Dwight Seabury	12 East Ave.
Pawtucket	S. Willard Thayer	Dexter Yarn Co.
Pawtucket	Fred A. Wilde	A. T. Atherton Machine Co.
Peace Dale	William C. Greene	Peace Dale Manufg. Co.
Phenix	Henry R. Brown	Phenix Mill.
Pontiac	Walter B. Hall	Pontiac Mill, B. B. and R. Knight.
Providence	Charles T. Aldrich	Aldrich Manufg. Co.
Providence	William Ames	Fletcher Mfg. Co.
Providence	George R. Babbitt	American Oil Co.
Providence	Edward R. Ballou	Ballou Yarn Co.
Providence	Truman Beckwith	Dyerville Manufg. Co.
Providence	J. Frank Braids	Charles S. Bush Co.
Providence	H. Martin Brown	U. S. Bobbin & Shuttle Co.
Providence	E. C. Bucklin	Interlaken Mills.
Providence	Harris H. Bucklin	Interlaken Mills.
Providence	Charles H. Child	Standard Mill Supply Co.
Providence	Frederick I. Dana	The Textile Machinery Finishing Co.
Providence	A. Lockwood Danielson	Quinebaug Co.
Providence	J. DeForest Danielson	Lockwood Co. and Lewiston Bleachery and Dye Works.
Providence	John W. Danielson	Lockwood Co., Ponemah Mills, Quinebaug Co., Wauregan Co., & Lewiston Bleachery & Dye Works.
Providence	John Henry English	English Greene Co.
Providence	F. C. Fletcher	Lawton Spinning Co.
Providence	J. Herbert Foster	10 South Water St.
Providence	Arthur C. Freeman	Textile Finishing Machinery Co.
Providence	William Gammell	Berkeley Co.
Providence	Rufus B. Goff	Standard Mill Supply Co.
Providence	John H. Hambly	Quidnick Mfg. Co.
Providence	A. Walter Harris	A. W. Harris Oil Co.
Providence	Elisha H. Howard	Cotton Goods Broker.
Providence	Frederic W. Howe	Crompton & Knowles Loom Works.
Providence	Daniel Jackson	B. B. & R. Knight.
Providence	Albert F. Knight	Box 835.
Providence	John E. Kendrick	American Supply Co.
Providence	Stephen A. Knight	Hebron Manufg. Co.
Providence	Webster Knight	B. B. & R. Knight's Mills.
Providence	W. C. Langford	86 Weybosset St.
Providence	J. Colby Lewis	23 Ralph St.
Providence	Henry F. Lippitt	Social and Manville Cos.

Providence	Charles R. Makepeace	Box 973.
Providence	F. H. Maynard	Gen. Fire Extinguisher Co.
Providence	Thomas Mayor	Thomas Mayor & Son.
Providence	John G. McFadden	Nottingham Mill.
Providence	Charles H. Merriman, Jr.	Manville Co.
Providence	William C. Peirce	Elizabeth Mills.
Providence	Reuben Pilling, Jr.	104 Harrison St.
Providence	Stephen Minot Pitman	Narragansett Mutual Fire Ins. Co.
Providence	Charles A. M. Praray	Chas. A. M. Praray & Co.
Providence	George W. Robbins	Dyerville Mfg. Co.
Providence	Frank P. Sheldon	Industrial Trust Building.
Providence	Harry M. Smith	Standard Mill Supply Co.
Providence	Wilton H. Spencer	7 Exchange Place.
Providence	Daniel J. Sully	T. M. Reynolds & Co.
Providence	Robert Rennie Taft	P. O. Box 1443.
Providence	Robert W. Taft	Coventry Co.
Providence	Charles F. Taylor	Burgess Cop Tube Co.
Providence	D. M. Thompson	F. W. Reynolds Co.
Providence	James T. Thornton	Thornton Machinery Co.
Providence	H. A. Tillinghast	The Textile Finishing Machinery Co
Providence	A. Curtis Tingley	National Ring Traveler Co.
Providence	W. O. Todd	Lawton Spinning Co.
Providence	Robert B. Treat	Manufacturers' Fuel Co.
Providence	William P. Vaughan	Putnam Mfg. Co.
Quidnick	O. B. Parker	Quidnick Mfg. Co.
Riverpoint	Arthur F. Brackett	Royal Arctic and Valley Queen Mills
Valley Falls	Edward B. Jennings	Samoset Co.
Warren	Arnold Schaer	Warren Manufg. Co.
Westerly	Robert Dow	Solway Mills.
Westerly	A. E. Henry	Solway Mills.
Westerly	Robert B. Meikle	Lorraine Mfg. Co.
Wickford	Joseph Warren Greene	
Woonsocket	Malcolm Campbell	Woonsocket Mach. & Press Co.
Woonsocket	Harry K. Drew	Clinton Mfg. Co.
Woonsocket	William Halliwell	Providence and Woonsocket Mill of the Lawton Spinning Co.
Woonsocket	W. G. Hartford	Hamlet Textile Co.
Woonsocket	Edward W. Houghton	Globe Mill, Manville Co.
Woonsocket	Henry S. Houghton, Sr.	61 Pond St.
Woonsocket	Albert C. Hoy	
Woonsocket	William N. Kimball	Social and Nourse Mills.
Woonsocket	Frederick Ott	Hamlet Textile Co.
Woonsocket	Hadey D. Perkins	Sharp, Perkins & Co.
Woonsocket	William A. Robinson	Manville Co.
Woonsocket	Charles E. Thomas	Forestdale Mfg. Co.

CONNECTICUT.

Baltic	Harold Lawton	Baltic Mills Co.
Danielson	Gordon A. Johnstone	Danielson Cotton Co.
Danielson	James Herbert Smith	Quinebaug Co.
Jewett City	Frederick D. Ballou	W. A. Slater Mills.
Jewett City	James O. Sweet	Ashland Cotton Co.
Jewett City	Adelbert R. Young	Ashland Cotton Co.
Killingly	H. C. Atwood	Williamsville Manufg. Co.
Killingly	W. E. Atwood	Williamsville Manufg. Co.
Killingly	C. H. Truesdell	Attawaugan Co.
Middletown	Joseph Merriam	Springfield Webbing Co.
Middletown	J. F. Powers	Spinning Mill.
Moosup	William J. Cray	Aldrich Mfg. Co.
Montville	Emory S. Rathbun	Pequot Mills.
New Haven	George S. Barnum	The Bigelow Co.
New London	Louis L. Hohn	Cor. Conn. Ave. and McDonald St.
Norwich	W. N. Blackstone	Attawaugan Co. and Totokett Mills Co.
Norwich	W. R. Burnham	
Norwich	C. H. Frisbie	Attawaugan Co. Arisba Mills Co.
Norwich	W. G. Henderson	Falls Co.
Norwich	Charles D. White	Uncasville Manufg. Co.
Norwich	Wm. I. Woodward	Shetucket Co.
Putnam	George W. Holt	Monohansett Manufg. Co.
Putnam	George A. Vaughan	Putnam Manufg. Co.
Taftville	Joseph D. Aiken	Ponemah Mills.
Taftville	John Eccles	Ponemah Mills.
Uncasville	Robert G. McMeehan	Uncasville Mfg. Co.
Versailles	John H. Holt	Totokett Mills Co.
Voluntown	George T. Briggs	The Briggs Mfg. Co.
Wauregan	James A. Atwood	Wauregan Co. & Quinebaug Co.
Wauregan	John Walter Atwood	Wauregan Co.
Willimantic	Peter Hardman	American Thread Co., Willimantic Mills.
Willimantic	Dickerson G. Baker	American Thread Co.
Willimantic	E. S. Boss	American Thread Co.
Willimantic	Joseph Mercer	Willimantic Cotton Mills Co.
Windsor Locks	J. R. Montgomery	The J. R. Montgomery Co.

NEW YORK.

Brooklyn	Hugh De Haven	De Haven Mfg Co.
Capron	W. H. Cloher, Jr.	Utica Cotton Co.
Chadwicks	Bradford C. Divine	Utica Willowvale Bleaching Co.
Cohoes	David S. Johnston	Harmony Mills.
Cohoes	Henry C. Phillips	Harmony Mills.
Cohoes	William H. Robinson	No. 3 Harmony Mill.

Elmira	William H. Bilbrough	Elmira Knitting Mills and Conewawah Spinning Co.
Jamestown	Thomes Henry Smith	Jamestown Cotton Mill.
Newburgh	William J. Hadfield	124 Smith St.
New York City	George Arms	Grand Hotel.
New York City	Edwin H. Baker	Bliss, Fabyan & Co.
New York City	D. C. Ball	5 Beekman St.
New York City	Percy H. Brundage	49 Wall St.
New York City	French Campbell	James Freeman Brown Co.
New York City	Albert C. Case	25 Broad St. Room 1213.
New York City	J. E. Cheesman	Cheesman Cotton Gin Co.
New York City	C. C. Cowan	27 William St.
New York City	Charles Henry Davis	25 Broad St.
New York City	L. L. Flemming	American Cotton Co.
New York City	Vladimir F. Gnesin	68 Broad St
New York City	Frederick Stewart Greene	American Mfg. Co.
New York City	Ernest L. Hill	Renfrew Mfg. Co.
New York City	William M. Lovering	24 Thomas St.
New York City	Arthur B. Mann	J. H. Martin & Co.
New York City	John R. Mitchell	Mitchell-Bissell Co.
New York City	Arthur Parkinson	Arabol Mfg. Co.
New York City	Duncan D. Parmly	Johnson Mfg. Co. & Dunbar Mills Co.
New York City	Vladimir P. Polevoy	120 Broadway
New York City	Chas. F. Pray	Cloth Broker.
New York City	Theodore H. Price	Cotton Dealer.
New York City	William N. Shaw	The Lincoln Iron Works & Jackson Architectural Iron Works.
New York City	George A. Wies	Eureka Fire Hose Co.
New York City	George H. Watson	The Northern Engineering Co.
New York Mills, Oneida Co.,	John P. Campbell,	New York Mills.
Oswego	George E. Farrell	Ontario Knitting Co.
Syracuse	Sanford E. Loring	341 Delaware St.
Utica	George DeForest	Utica Steam and Mohawk Valley Cotton Mills.
Utica	D. W. Gray	Skenandoa Cotton Co.
Utica	Henry F. Mansfield	Utica Steam Cotton Mills and Mohawk Valley Cotton Mills.
Utica	Pardon B. Sanford	Utica Spinning Co.
Utica	Albion K. Searls	Oneita Knitting Mills.
Utica	John B. Wild	Oneita Knitting Mills.

NEW JERSEY.

East Newark	Halsey Connett	Clark Mile End Spool Cotton Co.
Gloucester City	Philip H. Fowler	417 Monmouth St.
Gloucester	George W. Turner	Argo Mills Co.
Jersey City	Ernest Bridge	Jas. Chadwick & Bro. Ltd.

Jersey City	Maxwell Grierson	Jas. Chadwick & Bro., Ltd.
Jersey City	B. L. Stowe	Eureka Fire Hose Co.
Millville	John F. Reardon	Millville Mfg. Co.
Newark	William H. Loftus	Clark Thread Co.
New Brunswick	William Henry Hobbs	Johnson & Johnson Co.
New Brunswick	William H. Ritter	Johnson & Johnson.
Passaic	E. W. Davenport	Brighton Mills.
Passaic	Dudley T. Lyall	Brighton Mills.
Passaic	William L. Lyall	Brighton Mills.
Passaic	John W. Ramsbottom	Brighton Mills.
Paterson	J. E. Barbour	Barbor Flax Spinning Co.
Paterson	John W. Ferguson	Paterson Nat. Bank Bldg.

PENNSYLVANIA.

Chester	W. T. Galey	Aberfoyle Manufg. Co.
Chester	D. Edwin Irving	The Irving & Leiper Manufg. Co.
Chester	D. Irving Trainer	Agt. Lincoln Mfg. Co.
Frankford, Phila.	Walter R. Garsed	Wingohocking Cotton Mills.
Lancaster	Henry G. McCarter	John Farnum & Co. Conestoga Mills 2 & 3.
Mt. Joy	Thomas J. Brown	George Brown's Sons.
Philadelphia	Robert Beatty	Robt. Beatty & Co.
Philadelphia	T. Ashby Blythe	Ashby Cotton Mills.
Philadelphia	Alfred H. Burnham	Glasgow Mills.
Philadelphia	Harry W. Butterworth	H. W. Butterworth & Sons.
Philadelphia	James Butterworth	H. W. Butterworth & Sons.
Philadelphia	Frederick A. Downes	Keystone Mutual Fire Insurance Co.
Philadelphia	Edward W. France	Philadelphia Textile School.
Phildelphia	Simon Friedberger	Friedberger Mfg. Co.
Philadelphia	Merrill A. Furbush	2015 North 33rd St.
Philadelphia	Otto Goetze	Glasgow Mills, Kensington Station.
Philadelphia	John T. Greenwood	R. Greenwood & Bault.
Philadelphia	Henry S. Grove	Argo Mills Co.
Philadelphia	James Henry	Thomas Henry & Sons.
Philadelphia	Wililam G. Henry	Thomas Henry & Sons.
Philadelphia	W. C. Houston	Hope Mills Mfg. Co.
Philadelphia	John H. Lorimer	Ontario and Lawrence Sts.
Philadelphia	David Milne	Washington Ave and 10th & 11th Sts.
Philadelphia	Edward H. Sanborn	Cold Spring Bleach. & Fin. Works.
Philapelphia	Albert E. Schofield	Delph Spinning Co.
Philadelphia	William T. Westerman	Ontario Spinning Co.
Philadelphia	George Wood	Millville Mfg. Co.
Philadelphia	John P. Wood	521 N. 22nd St.
Philadelphia	Oscar W. Wood	Germantown Spinning Co.
Pittsburg	J. A. Shepherd	The Stirling Co.

Reading	Albert Deabill	Reading Hosiery Co.
Yardley	Theodore C. Search	Cold Spring Bleaching and Finishing Works.
Yardley	R. Irving Tobey	Cold Spring Bleaching and Finishing Works.

DELAWARE.

Wilmington	William P. Bancroft	Joseph Bancroft & Sons Co.
Wilmington	Daniel Moore Bates	Joseph Bancroft & Sons Co.

MARYLAND.

Baltimore	E. Stanley Gary	Gary Mfg. Co.
Baltimore	James A. Gary	Gary Mfg. Co.
Baltimore	W. F. Fowler	Westinghouse Elec. & Mfg. Co.
Baltimore	Wm. E. Hooper	Woodberry Division of Mt. Vernon Woodberry Co.
Baltimore	Charles K. Oliver	Continental Bldg.
Ilchester	Samuel F. Patterson	Thistle Mills Co.

NORTH CAROLINA.

Asheville	William Whittam, Jr.	The William Whittam Textile Co.
Charlotte	S. B. Alexander, Jr.	S. B. Alexander, Jr. Co.
Charlotte	Byron F. Card	Charlotte Machine Co.
Charlotte	E. N. Clemence	
Charlottee	Edward T. Garseed	
Charlotte	R. M. Miller, Jr.	Elizabeth Mills.
Charlotte	Daniel A. Tompkins	D. A. Tompkins Co.
Cooleeme	Henry J. Forsyth	Cooleeme Cotton Mill.
Durham	O. W. Stites	Elliott Fuel Saving Co.
Fayetteville	Frank H. Cotton	
Fayetteville	Walter L. Holt	Holt-Morgan Mills.
Greensboro	Caesar Cone	Proximity Mfg. Co.
Greensboro	Farquharson J. Muir	Cone Export & Commission Co.
Hope Mills	Eben C. Willey	Hope Mills Mfg. Co.
Lincolnton	R. S. Reinhardt	Elm Grove Cotton Mills.
Mountain Island	W. T. Jordan	Mt. Island Manufg. Co.
Winston-Salem	John W. Fries	F. & H. Fries. & Arista Mills Co.

SOUTH CAROLINA.

Chester	William G. Nichols	Springstein Mills.
Columbia	Louis I. Guion	Columbia Mills Co.
Columbia	James Sumter Moore	Olympia & Richland Cotton Mills.
Columbia	W. H. Rose	Richland, Granby & Olympia Cotton Mills.

Columbia	Edward W. Thomas	Richland, Granby & Olympia Mills.
Columbia	W. B. Smith Whaley	Richland & Granby Cotton Mills.
Gaffney	H. D. Wheat	Gaffney Mfg. Co. and Orient Mfg. Co.
Graniteville	T. H. Rennie	Graniteville Mfg. Co.
Greenville	James B. Duggan	Union Bleaching and Finishing Co.
Lancaster	Leroy Springs	Lancaster Cotton Mills.
Langley	Arthur T. Smith	Langley Manufg. Co. and Aiken Manufg. Co.
Newberry	Edward B. Wilbur	Mollohon Mfg. Co.
Pelham	D. G. Sunderland	The Pelham Mills.

GEORGIA.

Atlanta	Samuel A. Carter	Gate City Cotton Mills.
Atlanta	W. L. Draper	Dodge Mfg. Co.
Atlanta	Oscar Elsas	Fulton Bag and Cotton Mills.
Atlanta	Henry E. Fisher	Atlanta Cotton Mills.
Atlanta	Harry W. Kimball	Fulton Bag and Cotton Mills.
Atlanta	D. E. McGaw	293 Courtland St.
Atlanta	William M. Nixon	Atlanta Woolen Mills.
Augusta	Thomas Barrett, Jr.	Langley & Aiken Mills.
Augusta	John W. Chafee	The Sibley Mfg. Co.
Augusta	T. I. Hickman	Graniteville Mfg. Co.
Augusta	Otis G. Lynch	Enterprise Manufg. Co.
Augusta	Peleg A. Rhodes	Cotton Mill Mutual Fire Ins. Co.
Augusta	Joel Smith	1311 15th St.
Augusta	George R. Stearns	Riverside Mills.
Chattahoochee	W. R. B. Whittier	Whittier Mills.
Columbus	Frederick B. Gordon	Columbus Mfg. Co.
Columbus	Charles H. Gorton	Columbus Mfg. Co.
Columbus	Walter Rigby	Bibb Mfg. Co.
Columbus	George W. Towne	Columbus Power Co.
Commerce	Charles M. Sears	Harmony Grove Cotton Mills.
East Point	Edward C. Beach	Gate City Cotton Mills.
Griffin, Spalding Co.	Albert G. Martin	Kincaid Manufg. Co.
Lawrenceville	C. Enos Bean	Lawrenceville Mfg. Co.
Lawrenceville	Albert E. McDonald	Lawrenceville Mfg. Co.
Lindale	Henry P. Meikleham	Mass. Mills in Georgia.
Macon	H. B. Hopson	Bibb Mfg. Co.
Macon	Logon Owen	Bibb Mfg. Co. Mill No. 1.
Macon	W. H. Richmond	Bibb Mill No. 2.
Macon	Broadus E. Willingham	Willingham Cotton Mills.

TENNESSEE.

Knoxville	William T. Lang	Brookside Mills.
Memphis	Jerome Hill	Jerome Hill Cotton Co.

MICHIGAN.

Muskegon	James W. Taylor	Amazon Knitting Co.

ILLINOIS.

Aurora	Henry Rowe	Anrora B. & D. Works.
Chicago	Frederick A. Flather	International Harvester Co.

MISSISSIPPI.

Agricultural College	William E. Winchester	Mississippi Textile School.
Starkville	Arthur Whittam	John M. Stone Cotton Mills.

LOUISIANA.

New Orleans	S. Odenheimer	Lane Mills.

KENTUCKY.

Henderson	Paul J. Marrs	Henderson Cotton Mills.
Louisville	Philip S. Tuley	Louisville Cotton Mills Co.

ALABAMA.

Birmingham	B. B. Comer	Avondale Cotton Mills.
Birmingham	Joseph O. Hannum	1805 10th Ave. So.
Cordova	Scott Maxwell	Indian Head Mills of Ala.
Huntsville	Walter B. Knight	Madison Mfg. Co.
Pell City	Arthur J. Draper	Pell City Mfg. Co.
Pell City	James R. Pearce	

CANADA.

Province of Ontario.

Cornwall	S. Greenwood	The Canadian Colored Cotton Mills Co., Ltd.
Hamilton,	Charles Owen Dexter	The Candian Colored Cotton Mills Co., Ltd.
Hamilton,	James M. Young	Hamilton Cotton Co.
Ottawa	Louis Simpson	Victoria Chambers.

Province of Quebec.

Montreal	Alfred Hawkesworth	Merchants Cotton Co.
Montreal	Fred Hawkesworth	Merchants Cotton Co.

Montreal	D. K. McLaren	751 Craig St.
Montreal	A. B. Mole	Dominion Cotton Mills Co.
Valleyfield	Ernest E. Clark	Montreal Cotton Co.
Valleyfield	Fred Lacey	Montreal Cotton Co.
Valleyfield	Charles H. Potter	Montreal Cotton Co.
Valleyfield	Lewis J. Young	Montreal Cotton Co.

NEW BRUNSWICK.

Milltown	Lewis Dexter, Jr.	The Canadian Colored Cotton Mills Co., Ltd.
St. John	John B. Cudlip	Cornwall and York Cotton Mills Co.

ENGLAND.

Huddersfield	John Sykes	English Card Clothing Co.
Manchester	William F. Parish, Jr.	Vacuum Oil Co. (Tech. Dept.)
Matlock, Derbyshire,	John Edward Lawton	American Thread Co.
Oldham	Robert Taylor Jr.	Asa Lees & Co., Ltd.

RUSSIA.

Moscow	Vladimir Malinin	Prochoroff Three Hill Mfg. Co.

JAPAN.

Hiogo	Hachiro Fukuhara	Kanegafuchi Spinning Co.

RECAPITULATION.

LOCATION OF MEMBERSHIP.

Maine	19
New Hampshire	28
Vermont	1
Massachusetts	348
Rhode Island	109
Connecticut	35
New York	42
New Jersey	16
Pennsylvania	33
Delaware	2
Maryland	6
North Carolina	17
South Carolina	13
Georgia	29
Tennessee	3
Illinois	2
Mississippi	2
Louisiana	1
Kentucky	2
Alabama	6
Province of Ontario	4
Province of Quebec	8
New Brunswick	2
England	4
Russia	1
Japan	1
	744

IN MEMORIAM.

JOHN L. JEROME.

JOHN LATHROP JEROME was born at Fabius, Onondaga County, New York, July 6, 1854. He entered Hamilton College in 1869, and graduated in 1873. Immediately after graduation, he became principal of the public schools of Central City, Col. In 1875, he entered the law office of SAYRE, WRIGHT & BUTLER, of Denver, to prepare for the bar. In 1877, he began the practice of law in which he was very successful. In May, 1893, he united with JOHN C. OSGOOD, JULIAN A. KEBLER and A. C. CASS in control and management of The Colorado Fuel & Iron Company and its subsidiary corporations. From 1892 to 1895, he aided in the establishment of The Overland Cotton Mill Company, in which he continued to increase his holdings until, in 1902, he owned practically all of it, and, in 1903, retiring from The Colorado Fuel & Iron Company, undertook the actual management of cotton mill affairs. The worries following the closing of this mill on account of the strike in both Northern and Southern coal fields of Colorado, caused his death. He died at his mountain home, La Hacienda, Buffalo Creek, Col., on Sunday morning, November 22, 1903.

His JEROME ancestors went from the Isle of Wight to New Haven, Conn., in 1700. In 1791, his great grandfather, JOHN JEROME, went to Panpey, Onondaga County, New York. His

grandfather, father, uncles, brothers and nephews were educated at Hamilton, both before and after it became Hamilton College. In 1876, he married LUCY WRIGHT SWEETLAND, of Cazenovia, N. Y., by whom he had three daughters, ELIZABETH, born in 1877, CORNELIA, born in 1879, and JANET, born in 1884. They all survive him.

He belonged to and had office in many social clubs. The University Club and Denver Club, of Denver, The University Club and Whist Club of New York City, The Chicago Club of Chicago; in ancestral and patriotic societies, The Sons of the Revolution, Colonial Wars; in religious and humanitarian organizations, business corporations and associations for varied public purposes too numerous to mention.

He was elected a member of this Association, April 23, 1903 and in his correspondence expressed great interest in this organization, whose meetings conditions of distance prevented him from attending.

WILLIAM J. CRAY.

WILLIAM J. CRAY died at Moosup, Conn., May 10, 1904. He was born in London, England, April 22, 1845. He came to this country in 1855 and located at Rockport, Mass. At the age of fourteen years he began work in a cotton mill, first as a carding boy, then as second hand and afterwards as overseer of carding, in which line of work he became an acknowledged expert. In 1863 he removed to Mason, N. H., where he was overseer of carding in the mill of the Greenville Mfg. Co. In 1865 he married MARY FRANCES KENYON of Manchester, N. H., who with two sons and a daughter survives him. From Mason Mr. CRAY went to Clinton, Mass., where he remained about seven years, being at first boss carder in the employ of the Lancaster Mills, and afterwards having entire charge of

carding in the plant of the Columbian Mfg. Co. From Clinton Mr. CRAY went to West Warren, Mass., where for nearly three years he had charge of carding in four mills and the oversight of spinning in two. What is known as No. 4 mill Mr. CRAY equipped throughout and started. Mr. CRAY afterwards entered the plant of the Grosvenordale Mfg. Co. at Grosvenordale, Conn., as boss carder in the No. 4 mill. A little later he became boss carder in the No. 2 mill at North Grosvenordale and then was promoted to the position of superintendent of the two mills at Grosvenordale. His services here were of great value to the company and his skill was recognized by all. At the end of about thirteen years Mr. CRAY resigned his position and came to Moosup, about eight years ago, as superintendent of the mill of the Aldrich Mfg. Co. in which position he showed great ability, particularly in original lines of work, among which the most important was the weaving of silk on cotton machinery. In his mill life Mr. CRAY was held in highest regard not only by his employers but by the overseers and help generally. He took much interest in political affairs, but steadfastly refused political office, except several years as chairman of the town committee of Thompson. He became a member of this Association April 25, 1901.

O. S. BROWN.

O. S. BROWN was born in Tiverton, R. I., February 27, 1837, being the son of ROLLIN H. and MARY M. (WHITMARSH) BROWN. The family moved to Slatersville when he was about two years old and it was in this town that he passed his earlier years, his first instruction in cotton manufacturing being given by Mr. SLATER, who taught him carding and for whom he worked a number of years.

In 1855 he was a student at the Academy at South Berwick, Me. He became overseer of carding in Whitinsville and always throughout his career took a special interest in the subject which he credited to the thorough instruction in that department in his earlier years.

In 1861 he worked at one of the mills at Lewiston as overseer, remaining until 1869 when he took charge of the carding in the three mills of the Great Falls Manufacturing Company at Somersworth, N. H., and in December, 1871, became superintendent which position he held until July, 1875, when he came to Salmon Falls as the agent of the Salmon Falls Manufacturing Company, which position he held for twenty-nine years, until the time of his death, which occurred January 30, 1904.

During this period he made many additions and improvements to the works among which were the first installation of an electric trolley line on mill property in the state of New Hampshire. This road was used for the transportation of material between the mills and also to and from the railroad. He changed the methods of catching the dust from the picker room, improved the water wheel plant and water connections and the driving for the various mills. He also improved the boiler and engine plant of the mills and remodelled the gas plant which furnished the light for the establishment.

He was one of the first to place electric motors in mills and made numerous improvements in the construction of the mill buildings, store houses and other buildings of the company. He installed the English system of carding and spinning into the mill and the results of some of his work on carding was contained in papers on: Cards, Volume 32, page 27; Card Grinding, Volume 39, page 25; Single Carding, Volume 30, page 38; Spinning Filling, Volume 34, page 56; which were read before this Association. He also made contributions on Sizing Yarn, Volume 56, page 45; Making up Costs, Volume 56, page 64; and Weights and Drafts, Volume 56, page 70.

In December, 1862, he married Miss EMMA A. STEVENS, who with their two sons are not living. In 1869 he married Miss

HATTIE E. SEIDERS who survives him, as does his two sons, Dr. HARRY BROWN of Whitinsville, Mass., and FRANK S. BROWN of Boston.

He was a member of the Masons and trustee of the State Industrial School of Manchester, N. H. and a member of the State Board of Equalization, president of the Salmon Falls Savings Bank, trustee of the Rollinsford Savings Bank, chairman of the Finance Committee and trustee of Berwick Academy and junior warden of Christ Episcopal Church of Salmon Falls, a member of the Textile Club and also of the New England Cotton Manufacturers Association, which he joined April 21, 1875.

PROCEEDINGS.

In accordance with the legal notice, the stated annual meeting of the Association was held in Huntington Hall, Boston, Mass., April 27th and 28th, 1904. The following 242 members and 97 guests were present.

HONORARY MEMBER.

HENRY SMITH PRITCHETT, LL. D., Boston, Mass.

ACTIVE MEMBERS.

ALFRED E. ADAMS, Whitinsville, Mass.
JOHN S. ADAMS, Jr., Adams, Mass.
JOSEPH D. AIKEN, Taftville, Conn.
THOMAS ARMSTRONG, No. Pownal, Vt.
EDWARD ATKINSON, Boston, Mass.
GEORGE A. AYER, Easthampton, Mass.
NATHANIEL F. AYER, Boston, Mass.
J. W. BAILEY, Fall River, Mass.
EDWARD R. BALLOU, Providence, R. I.
FREDERICK D. BALLOU, Jewett City, Conn.
J. E. BARBOUR, Paterson, N. J.
LEWIS E. BARNES, Methuen, Mass.
DANIEL MOORE BATES, Wilmington, Del.
ROBERT BEATTY, Philadelphia, Pa.
A. C. BENT, Taunton, Mass.
JOHN P. BODGE, Fall River, Mass.

A. E. Bosworth, Georgiaville, R. I.
Arthur F. Brackett, Riverpoint. R. I.
Albert W. Brainerd, Lawrence, Mass.
Christopher P. Brooks, New Bedford, Mass.
Henry R. Brown, Phenix, R. I.
E. R. Bullock, Pawtucket, R. I.
Robert Burgess, Pawtucket, R. I.
Edward N. Burke, Lowell, Mass.
Hervey Burnham, North Adams, Mass.
John L. Burton, Fall River, Mass.
Byron F. Card, Charlotte, N. C.
Charles E. Childs, Northampton, Mass.
Daniel Clark, Lowell, Mass.
Josiah G. Coburn, Newton, Mass.
Charles H. Collins, Ashton, R. I.
Frank B. Comins, Boston, Mass.
John J. Connell, Lowell, Mass,
William J. Cray, Moosup, Conn.
Philip Dana, Westbrook, Maine.
A. Lockwood Danielson, Providence, R. I.
E. W. Davenport, Passaic, N. J.
Charles W. Dennett, South Hadley Falls, Mass.
Edward P. Dennis, Lowell, Mass.
P. Y. DeNormandie, Boston, Mass.
Charles Owen Dexter, Hamilton, Ont., Can.
Henry C. Dexter, Pawtucket, R. I.
Eben S. Draper, Hopedale, Mass.
George Otis Draper, Hopedale, Mass.
William F. Draper, Hopedale, Mass.
John H. Dunn, Lowell, Mass.
Frank J. Dutcher, Hopedale, Mass.
Russell W. Eaton, Brunswick, Maine.
John Eccles, Taftville, Conn.
Frederick W. Ely, Greenville, N. H.
John H. Estes, Fall River, Mass.
Eugene Finocchiaro, Taunton, Mass.
William Firth, Boston, Mass.
Charles H. Fish, Dover, N. H.

M. F. FOSTER, Milford, N. H.
ARTHUR C. FREEMAN, Providence, R. I.
C. H. FRISBIE, Norwich, Conn.
E. STANLEY GARY, Baltimore, Md.
JAMES GEE, Fiskville, R. I.
CHARLES E. GETCHELL, Waltham, Mass.
WILLIAM C. GODFREY, Indian Orchard, Mass.
GEORGE P. GRANT, Jr., Fitchburg, Mass.
D. W. GRAY, Utica, N. Y.
FREDERICK STUART GREENE, New York, N. Y.
S. GREENWOOD, Cornwall, Ontario.
JOHN GREGSON, Fiskdale, Mass.
DAVID GROVE, Central Falls, R. I.
ARTHUR H. GULLIVER, Waltham, Mass.
FRANK J. HALE, Newton Upper Falls, Mass.
WALTER B. HALL, Pontiac, R. I.
Z. D. HALL, Adams, Mass.
JOHN F. HAMLET, Fall River, Mass.
WILLIAM D. HARTSHORNE, Lawrence, Mass.
WALTER M. HASTINGS, Lawrence, Mass.
CHESTER D. HATCH, Exeter, N. H.
SAMUEL E. HATHAWAY, Fall River, Mass.
WILLIAM B. HAWES, Fall River, Mass.
WILLIAM HAYES, Auburn, Maine.
ARTHUR N. HERSOM, Lowell, Mass.
ERNEST L. HERSOM, Fitchburg, Mass.
CHARLES H. HOBBS, Thorndike, Mass.
FRANKLIN W. HOBBS, Boston, Mass.
CHARLES M. HOLMES, New Bedford, Mass.
GEORGE W. HOLT, Putnam, Conn.
WILLIAM P. HOLT, Fall River, Mass.
HENRY S. HOUGHTON, Jr., Northbridge, Mass.
OTIS L. HUMPHREY, Lowell, Mass.
D. EDWIN IRVING, Chester, Pa.
LEONARD JOHNSON, Fall River, Mass.
DAVID S. JOHNSTON, Cohoes, N. Y.
W. E. KEACH, Fitchburg, Mass.
ROLAND R. KELLEY, Williamstown Sta., Mass.

JOHN KILBURN, Belmont, Mass.
JESSE A. KNIGHT, Taunton, Mass.
STEPHEN A. KNIGHT, Providence, R. I.
FRED LACY, Valleyfield, P. Q.
WALTER H. LANGSHAW, New Bedford, Mass.
HAROLD LAWTON, Baltic, Conn.
EVAN ARTHUR LEIGH, Boston, Mass.
CHARLES F. LIBBY, Lowell, Mass.
WILLIAM H. LOFTUS, Newark, N. J.
ARTHUR H. LOWE, Fitchburg, Mass.
WILLIAM L. LYALL, Passaic, N. J.
HERBERT LYMAN, Boston, Mass.
RONALD T. LYMAN, Boston, Mass.
JAMES R. MACCOLL, Pawtucket, R. I.
FREDERICK B. MACY, New Bedford, Mass.
CHARLES T. MAIN, Boston, Mass.
ALEXANDER MAKEPEACE, Fall River, Mass.
CHARLES R. MAKEPEACE, Providence, R. I.
HENRY F. MANSFIELD, Utica, N. Y.
THOMAS MAYOR, Providence, R. I.
ROBERT MCARTHUR, Biddeford, Maine.
WILLIAM G. MCLOON, Clinton, Mass.
JOHN TEMPEST MEATS, Taunton, Mass.
JOSEPH MERRIAM, Middletown, Conn.
EDWARD A. MONGEON, Lonsdale, R. I.
J. R. MONTGOMERY, Windsor Locks, Conn.
FRED W. MOORE, Millbury, Mass.
GEORGE B. MORISON, Boston, Mass.
ALBERT H. MORTON, Lowell, Mass.
JOHN NEILD, New Bedford, Mass.
ALBERT W. NOONE, Peterboro, N. H.
HENRY OSGOOD, Salem, Mass.
HERBERT W. OWEN, Dover, N. H.
O. B. PARKER, Quidnick, R. I.
WALTER E. PARKER, Lawrence, Mass.
WILLIAM C. PEIRCE, Providence, R. I.
WILLIAM D. PENNELL, Lewiston, Maine.
HAVEN C. PERHAM, Lowell, Mass.
J. F. POWERS, Middletown, Conn.
LAVATER W. POWERS, New Bedford, Mass.

GEORGE E. PREST, Worcester, Mass.
JOHN E. PREST, Worcester, Mass.
M. W. QUINN, Amesbury, Mass.
CHARLES H. RICHARDSON, Clinton, Mass.
ALFRED SAGAR, Methuen, Mass.
ARNOLD B. SANFORD, Boston, Mass.
PARDON B. SANFORD, Boston, Mass.
ARNOLD SCHAER, Warren, R. I.
ALBION K. SEARLS, Utica, N. Y.
WILLIS S. SHEPARD, Ponkapoag, Mass.
WILLIAM F. SHERMAN, Boston, Mass.
HERBERT H. SHUMWAY, Taunton, Mass.
J. C. SMITH, Fall River, Mass.
THOMAS HENRY SMITH, Jamestown, N. Y.
GEORGE E. SPOFFORD, Blackstone, Mass.
T. B. STEVENSON, Manchang, Mass.
ROBERT STEWART, Ashton, R. I.
WILLIAM J. STEWART, Webster, Mass.
WALTER F. STILES, Fitchburg, Mass.
JOHN SULLIVAN, Fall River, Mass.
WALTER H. SUMMERSBY, Lawrence, Mass.
JAMES W. TAYLOR, Muskegon, Mich.
CHARLES E. THOMAS, Woonsocket, R. I.
JAMES O. THOMPSON, JR., New Bedford, Mass.
JAMES P. TOLMAN, Boston, Mass.
M. J. TOOHEY, Fall River, Mass.
GEORGE W. TOWNE, Columbus, Ga.
C. H. TRUESDELL, Killingly, Conn.
OSCAR B. TRUESDELL, Newtonville, Mass.
HERBERT E. WALMSLEY, New Bedford, Mass.
JOSEPH WATTERS, Fall River, Mass.
A. TENNY WHITE, Manville, R. I.
ALPHONSO F. WHITE, Forestdale, R. I.
JOHN B. WILD, Utica, N. Y.
HENRY WILLIAMS, Taunton, Mass.
ELIAS S. WILLIS, Lowell, Mass.
SAMUEL F. WINSPER, New Bedford, Mass.
C. J. H. WOODBURY, Lynn, Mass.
WILLIAM I. WOODWARD, Norwich, Conn.
ADELBERT R. YOUNG, Jewett City, Conn.

ASSOCIATE MEMBERS.

EUGENE C. ANDRES, Boston, Mass.
ALBERT BIRCH, Somerville, Mass.
F. H. BISHOP, Boston, Mass.
EDMUND E. BLAKE, Newton Upper Falls, Mass.
ARTHUR T. BRADLEE, Boston Mass.
J. FRANK BRAIDS, Providence, R. I.
HENRY GORDON BRINCKERHOFF, Boston, Mass.
H. MARTIN BROWN, Providence, R. I.
JOHN H. BURGHARDT, Boston, Mass.
CHARLES B. BURLEIGH, Boston, Mass.
EUGENE E. BURNHAM, Lawrence, Mass.
ARTHUR C. BUTLER, Boston, Mass.
HARRY W. BUTTERWORTH, Philadelphia, Pa.
MALCOLM CAMPBELL, Woonsocket, R. I.
W. W. CAREY, Lowell, Mass.
CHARLES H. CHILD, Providence, R. I.
MELVIN H. COFFIN, Whitinsville, Mass.
THOMAS G. COX, Taunton, Mass.
C. F. CURWEN, Salem, Mass.
JOSEPH L. CUSHING, Lowell, Mass.
DANIEL J. DANKER, Boston, Mass.
HUGH DEHAVEN, Brooklyn, N. Y.
JOHN O. DEWOLF, Boston, Mass.
C. E. W. DOW, Boston, Mass.
FRED W. EASTON, Pawtucket, R. I.
WILLIAM DRESSER EDWARDS, Boston, Mass.
G. B. EMMONS, Lawrence, Mass.
JOHN T. FYANS, Fall River, Mass.
H. P. GARLAND, Saco, Maine.
ROYAL W. GATES, Lowell, Mass.
VLADIMIR F. GNESIN, New York, N. Y.
RUFUS B. GOFF, Providence, R. I.
ALFRED H. HARTLEY, Fall River, Mass.
HENRY S. HOUGHTON. Sr., Woonsocket, R. I.
FREDERIC W. HOWE, Providence, R. I.
DAVID JACKSON, Pawtucket, R. I.
JOHN E. KENDRICK, Providence, R. I.
FRANK B. KENNEY, Lowell. Mass.

JOSEPH C. KING, Boston, Mass.
W. C. LANGFORD, Providence, R. I.
JOHN H. LAWRENCE, New Bedford, Mass.
STEPHEN C. LOWE, Boston, Mass.
D. EDGAR MANSON, Boston, Mass.
FAY H. MARTIN, Boston, Mass.
JOHN McCULLOUGH, New Bedford, Mass.
JOHN R. MITCHELL, New York, N. Y.
ROBERT W. NEFF, Boston, Mass.
JOHN H. NELSON, Lynn, Mass.
WILLIAM R. NOONE, Boston, Mass.
JOHN OLDFIELD, Everett, Mass.
SIDNEY B. PAINE, Boston, Mass.
ARTHUR PARKINSON, New York, N. York.
THEODORE H. PRICE, New York, N. Y.
DWIGHT SEABURY, Pawtucket, R. I.
LEWIS T. SHURTLEFF, New Bedford, Mass.
GEORGE W. STAFFORD, Readville, Mass.
H. E. STAFFORD, Readville, Mass.
JAMES STRANG, Indian Orchard, Mass.
GEORGE C. TEWKSBURY, Boston, Mass.
JAMES T. THORNTON, Providence, R. I.
A. CURTIS TINGLEY, Providenee, R. I.
ALLISON W. TRAFFORD, Fall River, Mass.
CLEMENT A. WAKEFIELD, Biddeford, Maine.
JUSTIN A. WARE, Springhill, Mass.
LETTICE R. WASHBURN, New Bedford, Mass.
WALTER S. WATSON, Lowell, Mass.
WILLIAM R. WEST, New Bedford, Mass.
W. W. WHITE, Worcester, Mass.
FRED A. WILDE, Pawtucket, R. I.
ERVING YALE WOOLLEY, Boston, Mass.

GUESTS.

A. A. ASPINWALL, Pawtucket, R. I.
W. W. BALLAGH, Boston, Mass.
JOHN S. BALLARD, New Bedford, Mass.
H. J. BALLOU, Boston, Mass.

C. H. BARCLAY, Boston, Mass.
H. K. BARNES, Boston, Mass.
Mrs. DANIEL MOORE BATES, Wilmington, Del.
W. J. BATTISON, Boston, Mass.
F. P. BLAKE, Boston, Mass.
E. R. BROOKE.
BENJ. C. BROWNELL.
J. A. BRYANT, Boston, Mass.
FRANK H. BURT, Boston, Mass.
I. W. CAMPBELL, Woonsocket, R. I.
JAMES S. CARTER, Worcester, Mass.
A. M. CHADWICK, Lowell, Mass.
F. L. CHASE, Providence, R. I.
J. A. COOPER, Whitinsville, Mass.
G. P. COPPINS, Boston, Mass.
FRED. CULVER, Taunton, Mass.
W. J. CURIT, Boston, Mass.
L. DANA.
H. J. DODGE, Boston, Mass.
R. C. EASTMAN, Providence, R. I.
A. M. FAIRLEY, Tarboro, N. C.
L. C. FARNSWORTH, Providence, R. I.
G. W. FOSTER, Providence, R. I.
A. M. FRASER, Fall River, Mass.
F. L. GARDNER, Boston, Mass.
W. H. GARNER, Newmarket, N. H.
M. E. GLEASON, Providence, R. I.
R. H. J. GODDARD, JR., Providence, R. I.
H. L. GREEN, Worcester, Mass.
R. B. GREGSON, New York, N. Y.
ADAM GROVE, Newark, N. J.
A. L. HAMBLY, Quidnick, R. I.
H. H. HIGGS, Amsterdam, N. Y.
J. W. HINDALE, New Bedford, Mass.
PHILIP R. HOVEY, Boston, Mass.
A. E. HOWES, Boston, Mass.
JOSEPH B. JAMIESON, Boston, Mass.
E. S. JOCELYN, Providence, R. I.
RICHARD JOHNSON, Oldham, Eng.

Wm. J. Johnson, Fall River, Mass.
H. J. Kittredge, Boston, Mass.
J. H. Lamb, Boston, Mass.
Leslie P. Langworthy, Providence, R. I.
G. Lewis, Boston, Mass.
Mrs. Channing Lilly, Wilmington, Del.
Henry G. Lord, Boston, Mass.
Philip C. Lowe.
J. P. Marsden, Oldham, Eng.
Henry Marsh, New Bedford, Mass.
John W. Mayor, Providence, R. I.
J. R. McKee, Schenectady, N. Y.
John B. McPherson, Boston, Mass.
Hans Meinl, Vienna, Austria.
John Merchant, Providence, R. I.
R. W. Merriam, Middletown, Conn.
E. L. Merron, Providence, R. I.
W. A. Moyer.
Charles M. Mumford, Providence, R. I.
F. L. Nagle, Boston, Mass.
John J. Nicholson, New Bedford, Mass.
G. S. Norton, Salem, Mass.
F. Olds.
George W. Owen, Lynn, Mass.
E. G. Page, Pawtucket, R. I.
A. H. Paul, Waltham, Mass.
J. F. Peck.
H. E. Prest, Worcester, Mass.
A. F. Ray, Boston, Mass.
R. L. Reynolds, Fall River, Mass.
E. A. Rusden, Providence, R. I.
C. A. Seity, Boston, Mass.
George Sherman, North Pownal, Vt.
A. P. Smith, New Bedford, Mass.
A. B. Spencer, Providence, R. I.
S. Steel, Boston, Mass.
G. F. Steele, Boston, Mass.
S. H. Steele.
Jacob Stephens, Pawtucket, R. I.
W. J. Stimpson, Hopedale, Mass.

A. F. SULLIVAN, Lowell, Mass.
W. C. THOMAS, Huntsville, Ala.
H. P. THOMPSON, Boston, Mass.
R. L. VAN DYKE, New York, N. Y.
H. C. VLIET, Newark, N. J.
E. W. WATERS, Fall River, Mass.
R. E. WATTLES, Canton.
P. C. WENTWORTH, Fall River, Mass.
FRANK W. WESTON, Boston, Mass.
W. A. WHITE, Lowell, Mass.
W. D. WHITE, Worcester, Mass.
WALTER WOOD, Philadelphia, Pa.
F. F. WOOLEY, Pawtucket, R. I.
H. Y. YAGI, Nagoya, Japan.

FIRST SESSION.

HUNTINGTON HALL, BOSTON, MASS.
WEDNESDAY, April 27, 1904.

The meeting was called to order at 11 A. M., President HERBERT E. WALMSLEY in the chair.

The PRESIDENT. Gentlemen, if you will please come to order, I declare the session opened and will request the Secretary to read the call for the meeting.

The Secretary read the call for the meeting as follows:

BOSTON, MASS., April 1, 1904.

To the Members:

Notice is hereby given that the stated Annual Meeting of this Association will be held at Boston, Mass., Wednesday and Thursday, April 27 and 28, 1904.

In acceptance of the invitation of the Massachusetts Institute of Technology the sessions will be held in Huntington Hall of the Rogers Building, 491 Boylston Street, which is between Berkeley and Clarendon streets. It may be reached by any street car connecting with the Boston Elevated Railroad system at the Park Street Station going south.

The sessions will be called to order on Wednesday at 11 A. M., and 2 P. M., and on Thursday at 10 A. M., and 2 P. M.

By order of the Board of Government,

C. J. H. WOODBURY,

Secretary.

HENRY S. PRITCHETT, LL.D., President of the Massachusetts Institute of Technology and an honorary member of this Association will greet the members with a welcome at the opening session.

The Board of Government especially hope that at this meeting the various papers will receive a full discussion and that inability to attend the meeting may not be considered by any one an impediment, as discussions may be written and sent to the Secretary to be read. For the purpose of furnishing better facilities for a discussion, the papers are to be printed in advance, if the manuscripts are received in time by the Secretary, and copies of such papers will be sent on request to any member five days before the meeting.

The full programme will not be issued until the meeting, but papers are expected on the following subjects:

Advantages of Rope Transmission in Textile Plants.
Approximate Cost of Mill Buildings.
Electric Transmission of Power.
Gas Power, Applied to the Textile Industry.
Humidity in Cotton Manufacturing.
Preparation for Mill Managment.
Our Consuls on Export Markets for Cotton Goods.
Origin of Sewing Cotton.
Roving Traverse Motion on Fly Frames.
The Carding Department.
The Cotton Situation.
The Spindle Situation.
The Thomas Universal Yarn Assorting Balance.

And other papers of which the exact titles have not been received.

The Boston Museum of Fine Arts invite the members to examine their collections of textiles at any time between 9 A. M. and 1 P. M., or between 2 P. M. and 5 P. M., on either day of the meeting. The mediæval fabrics are in Room 14 in the basement, and the laces, tapestries, rugs and velvets are in the Textile Gallery on the second floor.

Members will be admitted free on presentation of badge, and others will pay the usual entrance fee of twenty-five cents.

Attention is called to the amendment to the Constitution and By-Laws providing for life membership as adopted at the last meeting, for which several members have already qualified by payment of one hundred dollars.

"ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses."

The souvenir badges will be given to those members who are in attendance, and the Board of Government has given instructions that duplicates shall not be given until after the adjournment, but other souvenir badges will be given to the guests of members.

It is desired that applications for membership shall be received as far as possible in advance of the meeting.

A blank proposition for membership is enclosed for convenience in submitting the names of any who would be desirable members. Many persons have not become members because they have not been invited. Candidates for membership will receive the same privileges as the members. Blank propositions are also inside the front cover of the Transactions, or will be sent on application.

Members who have overlooked their postal card receipts for Transactions are requested to give the matter attention, as it is only through this means that the headquarters of the Association are able to know that members receive the volumes and notices to which they are entitled, and to keep an accurate record for sending Transactions and notices to members.

It is important that the Association should be promptly informed of changes of address of any members.

The SECRETARY. Mr. President, I certify that in accordance with article 14 of the constitution and by-laws, a copy of this notice was mailed to each member ten days at least in advance of this meeting and that a quorum is now present.

The programme for the meeting was as follows:

PROGRAMME.

First Session, Wednesday, April 27, 1904, at 11 A. M.

Call to Order.

Election of Officers.

Reports of the Secretary and Treasurer.

Award of the Association Medal.
CHARLES H. FISH, *Chairman.*

Welcome to the Association.
HENRY SMITH PRITCHETT, LL. D., President Massachusetts Institute of Technology.

President's Address.
HERBERT E. WALMSLEY, New Bedford, Mass.

The Cotton Situation.
THEODORE H. PRICE, 71 Wall St., New York City.

Preparation for Mill Management.
RUSSELL W. EATON, Brunswick, Maine.

Second Session, Wednesday, April 27, 1904, at 2.30 P. M.

The Origin of Sewing Cotton.
JAMES CLARK, Chapel House, Paisley, Scotland.

The Spindle Situation.
General WILLIAM F. DRAPER, Hopedale, Mass.

Advantages of Rope Transmission in Textile Plants.
FREDERICK S. GREENE, 65 Wall Street, New York City.

Our Consuls on Export Markets for Cotton Goods.
EDWARD N. VOSE, 290 Broadway, New York City.

Third Session, Thursday, April 28, 1904, at 10 A. M.

The Carding Department.
EBEN C. WILLEY, Hope Mills, N. C.

Humidity in Cotton Manufacturing.
GEORGE A. AYER, Easthampton, Mass.

Roving Traverse Motion on Fly Frames.
LOGAN OWEN, Macon, Ga.

The Thomas Universal Yarn Assorting Balance.
GEORGE W. THOMAS, 72A Deansgate, Manchester, England.

Fourth Session, Thursday, April 28, 1904, at 2 P. M.

Business.

Gas Power Applied to the Textile Industry.
B. H. THWAITE, 29 Great George Street, Westminster, London, S. W. England.

Approximate Cost of Mill Buildings.
CHARLES T. MAIN, Boston, Mass.

Electric Transmission of Power.
EDWARD W. THOMAS, Columbia, S. C.

The PRESIDENT. The Secretary will now be good enough to read the records of the last meeting.

The Secretary read the records of the seventy-fifth meeting of the Association, held at Lenox, Mass., September 29 to October 1, 1903, and on motion of Mr. J. R. MONTGOMERY it was voted that the same were accepted and approved.

ELECTION OF OFFICERS.

The PRESIDENT. The next business, gentlemen, before the meeting is the election of officers. What action will you take in this matter?

Mr. WILLIAM H. LOFTUS. Mr. President, I move that a nominating committee of three be appointed by the President to report later.

The motion was seconded by Mr. CHARLES H. FISH and carried.

The PRESIDENT. As such committee I appoint Mr. BYRON F. CARD, of Charlotte, N. C., Mr. CHARLES W. DENNETT, of South Hadley Falls, Mass., and Mr. WILLIAM H. LOFTUS, of Newark, N. J., which committee will, if agreeable, report tomorrow.

ANNOUNCEMENTS BY THE SECRETARY.

The SECRETARY. Mr. President, I have received the following telegram:

CHARLOTTE, N. C.,
April 26, 1904.

C. J. H. WOODBURY, *Secretary*,
New England Cotton Manufacturers' Association,
Boston.

Our President and Board of Governors extend to you our hearty good wishes for a pleasant and profitable meeting, and trust you will reiterate to your members our sincere invitation that they attend in the largest measure possible our eighth annual convention at Arlington Hotel, Washington, May 11 and 12.

C. B. BRYANT, *Sec'y and Treas.*,
American Cotton Manufacturers' Association.

(Applause.)

The SECRETARY. Furthermore, Mr. President, I am requested to give a notice which modifies the programme to a certain extent and I think you will consider for the better. The President of the Institute of Technology gives to the students from time to time the opportunity to hear distinguished speakers from abroad, and by coincidence JACOB RIIS of New York was to address the students tomorrow afternoon. Our session was appointed for two o'clock. JACOB RIIS will meet the students here at two o'clock precisely and his address will end at 2.30, therefore the session of the Association tomorrow afternoon will be postponed until 2.30, but a portion of the hall will be reserved for members of the Association, the President of the Institute, Dr. PRICHETT, thinking that you would like to see the students as well as to hear Mr. RIIS. And therefore I trust that all of you will come here promptly at 2 P. M. tomorrow, resting assured that the meeting of the Association will begin half an hour later.

THE PRESIDENT. The next business, gentlemen, in order is the reports of the Secretary and Treasurer.

THE SECRETARY'S REPORT.

The past year has been one of great moment to the Association which has been the natural result of increase in members and also the unprecedented size of its Transactions which has exceeded that of any former year.

The Board of Government have held seven meetings and kept closely in touch with the varied matters pertaining to the Association which came up for their consideration.

THE ASSOCIATION MEDAL.

The third Association medal was awarded last year to WILLIAM D. HARTSHORNE of Lawrence, Mass., for his paper on "Observations on Spindle Banding; a Plea for Something Better," contained in Volume 73, page 145 of the Transactions, being, as in the case of former medals, also based upon previous contributions by the recipient, the committee making the selection being Messrs. NATHANIEL B. KERR and ARTHUR H. GULLIVER.

The Board of Government appointed Messrs. CHARLES H. FISH, WILLIAM D. HARTSHORNE and SIDNEY B. PAINE a committee to recommend the award for the Association medal for this year and the decision of the committee will be made at this meeting.

THE STUDENTS' MEDAL.

The students' medal has been awarded to the following members of graduating classes of textile schools designated by the

Board of Government, the awards in each case being made to the scholar of the highest rank as determined by committees of members of the Association:

THEODORE WOOD, Waban, Mass., a graduate of the New Bedford Textile School, New Bedford, Mass.

FREDERICK ELLERY CHAMBERLAIN, 127 Paul Gore street, Jamaica Plain, Mass., a graduate of the Lowell Textile School.

HENRY WASHINGTON ATKINSON, Atlanta, Georgia, a graduate of the Georgia School of Technology, Atlanta, Georgia.

WILLIAM J. MANNER, Philadelphia, Pa., a graduate of the Philadelphia Textile School, Philadelphia, Pa.

LIFE MEMBERSHIP.

During the past year the Association adopted the following amendment to the Constitution for life membership:

"ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses."

At the time of the preparation of this report, three members have qualified for life membership under the provisions of this article, namely: CHARLES H. FISH, ROBERT W. NEFF and C. J. H. WOODBURY.

THE ELI WHITNEY TABLET.

The ELI WHITNEY Tablet which was prepared for the purpose of presentation to the ELI WHITNEY Country Club at Rocky Creek, near Augusta, Georgia, has been placed on the walls of the corridor of the Richmond County Court House at Augusta, Georgia, in accordance with the alternative provisions in the

deed of trust, as the ELI WHITNEY Country Club has not been able to carry out its plans for the construction of a club house.

This tablet which is conceeded by all to be a beautiful work of art in mural bronze, as well as a suitable memorial to the work of the illustrious inventor which it commemorates, is now in a prominent position at the nearest point to the scenes of the first practical operation of the saw gin, and is, therefore, to that extent more advantageously situated to meet the gaze of people than would have been the case at the site originally proposed.

MEMBERSHIP.

During the past year the Association has lost by death the following members:

O. S. BROWN, PATRICK T. CREED, JOHN L. JEROME, JOHN H. PARKS, JOHN R. ROSTRON, Capt. WILLIAM H. STRATTON and NELSON WHITTIER, and by resignation or otherwise, three of which were due to the transfer from associate to active membership, a total of 28.

At the beginning of the fiscal year the total membership was 670, which has been increased by the election of 68 at the two meetings, making a net membership of 703 in advance of this meeting. This will be increased to 744 if all of those whose propositions by various members have already received the approval of the Board of Government are elected.

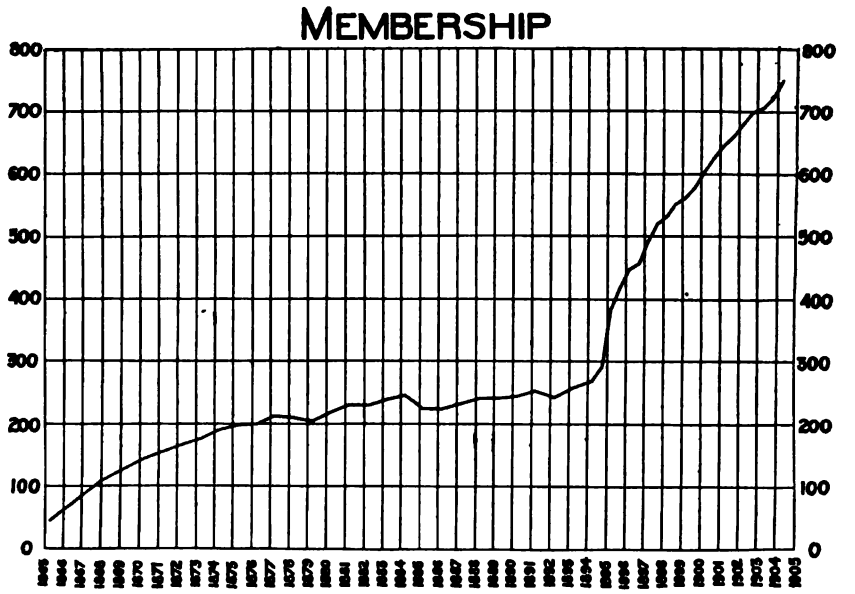
The following table shows the membership of the Association at various meetings since its foundation in April, 1865, the number elected and the number of present members.

MEMBERSHIP OF THE ASSOCIATION.

Number of Meeting.	DATE OF MEETING.	Membership.	Number of Present Members	Number Elected to Membership.
1	Apr. 20, 1865, Boston, Mass.	44	6	44
	July 19, 1865, Adj. Meeting,	—	3	42
2	July 18, 1866, Boston, Mass.	72	0	0
3	July 17, 1867, " "	—	1	10
4	Jan. 15, 1868, " "	108	0	32
5	July 15, 1868, " "	—	1	12
	Oct. 21, 1868, Adj. Meeting,	—	2	6
6	Apr. 21, 1869, Boston, Mass.	—	1	19
7	Oct. 20, 1869, " "	—	1	8
8	Apr. 20, 1870, " "	144	0	12
9	Oct. 19, 1870, " "	—	0	5
10	Apr. 19, 1871, " "	—	1	9
11	Oct. 18, 1871, " "	—	1	16
12	Apr. 17, 1872, " "	166	4	29
13	Oct. 16, 1872, " "	—	3	14
14	Apr. 16, 1873, " "	175	1	13
15	Oct. 15, 1873, " "	—	5	17
16	Apr. 15, 1874, " "	189	1	13
17	Oct. 21, 1874, " "	—	0	7
18	Apr. 21, 1875, " "	199	2	13
19	Oct. 27, 1875, " "	—	2	18
20	Apr. 26, 1876, " "	200	1	11
21	Oct. 25, 1876, " "	—	1	13
22	Apr. 25, 1877, " "	213	4	20
23	Oct. 31, 1877, " "	—	2	9
24	Apr. 24, 1878, " "	210	5	8
25	Oct. 30, 1878, " "	—	1	11
26	Apr. 30, 1879, " "	205	3	10
27	Oct. 29, 1879, " "	—	5	16
28	Apr. 28, 1880, " "	219	2	14
29	Oct. 27, 1880, " "	—	3	13
30	Apr. 27, 1881, " "	231	2	11
31	Nov. 30, 1881, " "	—	2	6
32	Apr. 26, 1882, " "	231	2	9
33	Oct. 25, 1882, " "	—	2	5
34	Apr. 25, 1883, " "	240	4	15
35	Oct. 31, 1883, " "	—	3	10
36	Apr. 30, 1884, " "	247	4	9
37	Oct. 29, 1884, " "	—	2	2
38	Apr. 29, 1885, " "	225	3	3
39	Oct. 28, 1885, " "	—	5	8
40	Apr. 28, 1886, " "	225	4	7
41	Oct. 27, 1886, " "	—	5	8

Number of Meeting.	DATE OF MEETING.	Membership.	Number of Present Members	Number Elected to Membership.
42	Apr. 27, 1887, Boston, Mass.	234	4	10
43	Oct. 27, 1887, " "	—	2	3
44	Apr. 25, 1888, " "	241	10	15
45	Oct. 31, 1888, " "	—	7	12
46	Apr. 24, 1889, " "	242	3	6
47	Oct. 30, 1889, " "	—	4	8
48	Apr. 30, 1890, " "	246	5	7
49	Oct. 29, 1890, " "	—	7	11
50	Apr. 29, 1891, " "	254	2	4
51	Oct. 28, 1891, " "	—	5	8
52	Apr. 27, 1892, " "	244	11	12
53	Oct. 26, 1892, " "	—	13	19
54	Apr. 26, 1893, " "	259	5	11
55	Oct. 25, 1893, " "	—	6	9
56	Apr. 25, 1894, " "	270	11	16
57	Sept. 27—28, 1894, Crawford House, N. H.	292	13	19
58	Apr. 24—25, 1895, Providence, R. I.	383	64	92
59	Oct. 24—25, 1895, Atlanta, Ga.	422	32	46
60	Apr. 29—30, 1896, Boston, Mass.	450	21	29
61	Sept. 22—24, 1896, Profile House, N. H.	459	16	19
62	Apr. 28—29, 1897, Boston, Mass.	495	35	43
63	Oct. 27—28, 1897, Philadelphia, Pa.	523	24	38
64	Apr. 27—28, 1898, Boston, Mass.	535	18	24
65	Sept. 27—29, 1898, Crawford House, N. H.	554	9	16
66	Apr. 26—27, 1899, Boston, Mass.	564	27	33
67	Oct. 5— 6, 1899, Montreal, P. Q.	580	17	22
68	Apr. 25—26, 1900, Boston, Mass.	603	31	38
69	Oct. 16—18, 1900, Washington, D. C.	628	34	38
70	Apr. 24—25, 1901, Boston, Mass.	647	29	33
71	Sept. 25—26, 1901, Niagara Falls, N. Y.	661	16	19
72	Apr. 23—24, 1902, Boston, Mass.	681	37	42
73	Sept. 30—Oct. 2, 1902, New York, N. Y.	699	20	24
74	Apr. 22—23, 1903, Boston, Mass.	706	38	41
75	Sept. 29—Oct. 1, 1903, Lenox, Mass.	723	27	27
76	Apr. 27—28, 1904, Boston, Mass.	744	41	41

The following diagram represents in graphical form the membership of the Association from its establishment.



THE CARD CATALOGUE.

The card catalogue which was first prepared over two years ago has been kept up to date and has maintained its usefulness, both for the purpose of the office work of the Association and also in furnishing citations and references to the numerous persons calling at the office.

The headquarters of the Association have been well patronized by members during the year and the bound volumes of the Transactions and also the books of reference and technical papers have been frequently consulted by those without the Association as well as by its members. The rooms have been called into frequent use by members for various business conferences during the year.

As the office copies of the Transactions of the Association were destroyed by fire February 2, 1890, there is a demand for copies earlier than that date, particularly on the part of the libraries of technical institutions, and the Secretary would like information of any earlier copies which may be for sale.

There is one complete set on sale of which further particulars may be obtained of the Secretary.

The Transactions of the following societies and periodicals are sent to the Association and kept on file.

Transactions of Technical Societies.

American Society of Civil Engineers,	New York.
American Society of Mech. Engineers,	New York.
American Institute of Elect. Engineers,	New York.
Boston Chamber of Commerce,	Boston.
Consular Reports, Bureau of Statistics,	Washington, D. C.
Japan Cotton Spinners' Association,	Osaka, Japan.
National Association of Wool M'frs,	Boston.
National Electric Light Ass'n,	New York.
Western Society of Civil Engineers,	Chicago.

List of Periodicals Kept on File.

American Cotton Manufacturer,	Charlotte, N. C.
American Industries,	New York, N. Y.
American Wool and Cotton Reporter,	Boston.
Boston Journal of Commerce,	Boston.
Cassier's Magazine,	New York.
Cotton,	Atlanta.
Cotton,	Manchester, Eng.
Dry Goods Economist,	New York.
Dun's Review,	New York.
Dun's Review, International Edition,	New York.
Engineer,	Chicago.
Engineering Record,	New York.
Fibre and Fabric,	Boston.
Freight,	New York.
Iron Age,	New York.
Lowell Textile Journal,	Lowell.

Machinery,	New York.
Manufacturers' Record,	Baltimore.
Mill and Shop,	Boston.
New England Shoe and Leather Association Monthly Gazette,	Boston.
New York Commercial,	New York.
Power,	New York.
Practical Engineer,	Philadelphia.
Protectionist,	Boston.
Technical World,	Chicago.
Textile American,	Boston.
Textile Manufacturers' Journal,	New York.
Textile Recorder,	Manchester, Eng.
Textile World Record,	Boston.

Respectfully submitted,

C. J. H. WOODBURY,

Secretary.

April 20, 1904.

Mr. CHARLES H. CHILDS. I move that the report be accepted.

The motion, being seconded by Mr. MONTGOMERY, was put to vote and carried.

TREASURER'S REPORT.

C. J. H. WOODBURY, TREASURER, IN ACCOUNT WITH THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

April 1, 1903 to April 1, 1904.

DEBTORS.

Cash,	$542 12	
Life membership,	300 00	
Active membership dues,	2,725 00	
Associate membership dues,	1,435 00	
Active admission fees,	530 00	
Associate admission fees,	250 00	
Interest,	49 69	
Sale of Transactions,	95 30	
Advertising,	1,315 00	
Medal and Certificate Fund,	1,000 00	
Engraving,	20 85	
Miscellaneous,	72 51	
Students' Medal Fund,	200 00	
Whitney Tablet Fund,	1 15	
New England Cotton Manufacturers' Association, Scholarship, donation of Wm. Firth,	3,000 00	
		$11,536 62

CREDITORS.

Board of Government,	$135 49	
Office rent,	399 96	
Amount forward,		$535 45

Amount forward,	$535 45	
Secretary and Treasurer,	1,958 37	
Reports of meetings,	45 00	
Notices and stationery,	118 65	
Meeting expenses,	247 00	
Printing and distributing Transactions,	2,438 84	
Badges,	48 00	
Stenographer and proof,	840 37	
Advance copies of papers,	298 50	
Engraving,	156 01	
Miscellaneous,	37 61	
Postage, telegrams and express,	214 64	
Office supplies and furniture,	28 78	
Medal and Certificate Fund,	68 58	
New Bedford Textile School Scholarship Fund,	3,000 00	
Whitney Tablet,	12 95	
Securities and cash,	1,487 87	
		$11,536 62

AUDITOR'S REPORT.

I hereby certify that the amounts from April 1, 1903, to April 1, 1904, are correctly cast, that all payments are properly vouched for, that the funds are kept on deposit in the name of the New England Cotton Manufacturers' Association, and that the amount of the deposit April 1, 1904, agrees with the balance in the books, viz., $287.87.

The securities in which the Association funds have been invested have been examined.

C. E. ROBERTS, *Auditor.*

BOSTON, MASS., April 4, 1904.

The earnings of the Association for the year may be placed as:

3 life members,	$300 00	
567 active members at $5.00,	2,835 00	
153 associate members at $10.00,	1,530 00	
56 active admissions at $10.00,	560 00	
12 associate admissions at $25.00,	300 00	
Advertising,	1,450 00	
Miscellaneous,	239 50	
Total,		$7,214 50

The disbursements of the year amounted to $6,848.75 which is $365.75 less than the earned income.

The bills receivable are:

Active dues,	$415 00	
Associate dues,	360 00	
Advertisements,	300 00	
Miscellaneous,	14 80	
Total,		$1,089 80

There are no bills payable.

The income derived from advertisements has enabled the Association to be conducted on the same basis as other technical organizations which are supported by higher assessments as well as by advertisements in their transactions. The receipts from this source have amounted in the several volumes of the Transactions to:

63	Philadelphia, October, 1897,	$385 00
64	Boston, April, 1898,	420 00
65	Crawford House, September, 1898,	450 00
66	Boston, April, 1899,	550 00
67	Montreal, October, 1899,	445 00
68	Boston, April, 1900,	580 00
69	Washington, October, 1900,	665 00
70	Boston, April, 1901,	620 00
71	Pan-American, September, 1901,	595 00
72	Boston, April, 1902,	575 00
73	New York, September — October, 1902,	645 00
74	Boston, April, 1903,	745 00
75	Lenox, September — October, 1903,	705 00
76	Boston, April, 1904 (already under contract),	475 00

The following table presents the finances of the Association for the past fourteen years. It will be noted that the cost of maintaining the work of this Association on the unit of the cost per page of the Transactions for each member is less than at any former year.

Fiscal Year Ending April 1.	MEMBERSHIP. Enrollment.	MEMBERSHIP. Members Elected.	TRANSACTIONS. Volume Number.	TRANSACTIONS. Pages in Volume.	TRANSACTIONS. Pages for Year.	FINANCES. Cash Receipts.	FINANCES. Expenses.	FINANCES. Cost per Page of Transactions.	FINANCES. Cost per Member.	FINANCES. Cost per Page of Transactions for each member Cents.
1891	246	18	48	43	105	$1,142 00	$ 926 08	$8 82	$3 76	3.59
			49	62						
1892	254	12	50	129	189	1,260 68	1,374 46	7 27	5 41	2.86
			51	60						
1893	244	31	52	63	157	1,678 33	1,603 25	12 22	6 57	6.33
			53	94						
1894	259	19	54	84	170	1,414 58	1,807 60	10 63	7 03	4.14
			55	86						
1895	270	35	56	73	303	1,947 07	1,957 64	6 46	6 71	2.21
	292		57	230						
1896	383	142	58	310	637	4,579 19	3,636 31	5 71	8 59	1.34
	422		59	327						
1897	450	49	60	269	628	3,710 02	3,980 34	6 33	8 67	1.43
	459		61	359						
1898	495	83	62	353	806	4,717 08	4,333 85	5 38	8 28	1.18
	523		63	453						
1899	535	42	64	321	701	4,713 56	4,775 97	6 81	8 62	1.23
	554		65	380						
1900	564	56	66	464	760	5,237 53	5,007 23	6 57	8 63	1.14
	580		67	296						
1901	603	78	68	382	858	6,331 93	6,295 55	7 34	10 02	1.16
	628		69	476						
1902	647	52	70	366	745	6,724 23	6,035 84	8 10	9 13	1.22
	661		71	379						
1903	681	66	72	342	757	6,768 81	6,701 65	8 85	9 58	1.26
	699		73	415						
1904	706	68	74	512	886	6,794 50	6,848 75	7 73	9 47	1.07
	723		75	374						

Respectfully submitted,

C. J. H. WOODBURY,

Treasurer.

April 4, 1904.

On motion of Mr. CHARLES H. FISH the report of the Treasurer was accepted.

AWARD OF THE ASSOCIATION MEDAL.

THE PRESIDENT. Gentlemen, we now come to a very pleasing and interesting part of our programme, that is, the awarding of the Association medal. The Committee who award this medal are Mr. CHARLES H. FISH, Mr. WILLIAM B. HARTSHORNE and Mr. SIDNEY B. PAINE. We are now ready to learn their award, gentlemen.

Mr. CHARLES H. FISH, for the Committee, read the following report:

REPORT OF COMMITTEE ON ASSOCIATION MEDAL.

To the New England Cotton Manufacturers Association.

Gentlemen — The Association Medal Committee appointed by your President begs to report as follows:

After careful investigation, we find that among the many valuable contributions there are several which certainly merit the highest commendation as being well expressed papers containing valuable information of a timely nature.

As furnishing a proper basis for an award of this medal, however, there is one in particular which bears the marks of close and original investigation and research, upon a subject which is of material interest to the members of the Association, from a purely manufacturing standpoint.

As an encouragement to the development of such researches the committee have unanimously agreed that the award should be made, for his valuable papers on "Gray Goods from the Bleacher's and Finisher's Point of View," Volume 66, page 226, "Cotton Export Trade with China," Volume 69, page 309, "Gray Goods for White Lawn Work," Volume 74, page 235,

and "Waxes in Warp Sizing," Volume 75, page 147, to DANIEL MOORE BATES of Wilmington, Delaware.

Respectfully submitted,

CHARLES H. FISH,
WILLIAM D. HARTSHORNE,
SIDNEY B. PAINE,
Committee.

BOSTON, April 27, 1904.

THE PRESIDENT. Mr. BATES, it gives me great pleasure to hand you this medal and to congratulate you in the name of the Association.

Mr. DANIEL MOORE BATES. Mr. President and gentlemen of the Association: I greatly appreciate this unexpected honor. I can hardly realize that the little work I have done for the Association is held in such high esteem, and I feel that this recognition is general rather than personal — that it is extended to all of us younger men with the assurance that the Association is ever on the lookout for signs of our interest and coöperation, ever ready to reward them. It is a pleasure to me, sir, to remember that it was from this platform I received my degree from the Institute of Technology eight years ago this June. Since that time I have devoted myself uninterruptedly to the manufacture and finishing of cotton goods, and I have felt more and more the breadth and scope of our profession, the limitless field for its development, both in markets and in methods of manufacture, the training which it gives a man in judgment, in decision, in initiative and in humanity. It is a splendid profession. I shall be unworthy, sir, of this honor if I do not take it as an earnest of renewed effort from myself and from all the younger men of our Association. [Applause.]

THE PRESIDENT. Gentlemen, it is now my pleasing duty to introduce to you Dr. HENRY S. PRITCHETT, President of the

Massachusetts Institute of Technology and an honorary member of this Association, through whose courtesy and consideration we are holding this convention in this hall. It seems peculiarly fitting and appropriate that an organization such as ours, composed very largely of practical men whose lives are devoted to practical work, should hold its meetings in this Institute — an Institute devoted to scientific and technical instruction and training for the great industries and commerce of this country. As you are well aware, the Massachusetts Institute of Technology is one of the oldest, one of the largest and certainly one of the most important and best appointed engineering and technical schools in the United States, both in regard to staff and general equipment, and meets adequately and efficiently the demands for a great industrial centre such as this. This famous institution has, I understand, turned out more useful and well equipped men than any other institution of its kind. I feel it a very high honor, gentlemen, to present to you President PRITCHETT, who in reality needs no introduction to an assemblage of this character.

ADDRESS OF WELCOME TO THE ASSOCIATION.

HENRY S. PRITCHETT, LL.D., President of the Massachusetts Institute of Technology, Boston, Mass.

Mr. President and Members — fellow-members, I am glad to say — of the New England Cotton Manufacturers' Association: I feel that the best introduction which the Massachusetts Institute of Technology can have to you is that which it is receiving year by year from the men it sends out. Perhaps your Secretary and he upon whom you have just conferred a medal make the best sort of introduction and recommendation which an institution of this kind can make to a manufacturers' association.

Let me say that no body of men could be more welcome here than you are. I wish you to believe me when I say that the halls of the Institute of Technology are at your disposal for your annual meeting whenever you will come. This hall is our largest. If it is too large for your use, we have others smaller, and we are ready to give them most freely and most gladly for your work and for your meeting whenever you will do us the honor to come and occupy them. [Applause.]

Let me say just one word, as I have only a few to say, with regard to the preparations for this meeting. You will find on this floor a large committee room capable of holding perhaps thirty or forty men, which will be at your disposal during the full time of your meeting. Should you need other committee rooms or larger ones an officer is detailed below whose business it is to provide them for you at any time, and I beg that you will understand that we wish to make you here as comfortable as our facilities will enable us to do. Coming in and out of

the corridor of the Rogers Building you will find a stream of students. I trust that that will not interfere with your comfort or with your pleasure. Anything that we can do we shall be glad to do to make this meeting or any other meeting which you will have here a success.

And one word, if I may, of the event of tomorrow afternoon. It was my fault that this engagement of some months' standing of JACOB RIIS of New York was not noticed until a day or two ago. Then it occurred to me that the Institute of Technology would like to show you, if you cared to see it, the best show that we have — that is, the boys of the institution. And if you care to come at two o'clock tomorrow afternoon sharp to hear Mr. RIIS speak to a crowd of young men gathered from all parts of the world, I can promise you the most interesting sight that you ever saw. There will be reserved on this platform fifty or sixty chairs. All of you who can do so may come in through the rear door and take those chairs, because the sight of this sea of young faces is one that you will remember to your dying day. In addition to that I shall have reserved here seats in front for you at two o'clock, and those of you who do not care to come on the platform may, I hope, find seats there. Only I give you this warning, that when sixteen hundred young men try to crowd themselves into this room you generally have to be here a few minutes before the hour in order to get in. There will be no difficulty in getting the seats on this platform, but I most cordially invite those of you who can to come and see this sight, for there is no other exhibit which we have to make which begins to equal in interest this great mass of faces which you will see from this platform tomorrow afternoon at two o'clock. After all, while we are trying to make engineers here, we are trying to make men first, and if you are interested in men I should like to have you come and take a look at these fellows.

Manufacturing and technical education are so closely related that either ought to be at home in the work place of the other. For the engineer, in the best sense, is no other than the solver

of practical problems. He is the real engineer who solves the problems before him most economically and most successfully with the means at hand.

I remember when I was on a railroad once we had an old trackman who had grown up in the business, a horney-handed, practical man who knew his business, and we imported about the same time a bright and very able young fellow from college as a division engineer. Soon after there was a freshet which washed out a bridge, a very important bridge, so that the traffic was seriously delayed. The General Manager sent orders in all directions to get every available man there and get that bridge up as soon as possible, and two days after he went down himself. Early in the morning, as he left his car and walked down to the scene of the work, he met this old trackman and asked him, "John, have you got the plans and drawings from the Division Engineer for the new bridge and got to work on them? This thing has got to be rushed through right away." "Well, Colonel," said the old man, I notice that all managers of railroad are colonels, I don't know whether they choose the managers of the railroads from the ranks of colonels, or whether they make a man a colonel after he gets to be a railroad manager, but they are all colonels. "Well, Colonel," he said, "I don't know whether the engineer has drawed the pictur yet or not, but the bridge is up and the trains are passing." [Laughter.]

Now in that case the real engineer was the man who met the problem with the facilities which were at his command. We believe that the training of the school prepares a boy to become a solver of problems, and in such a way able later to deal with the questions of manufacture and of engineering.

Ours is a day in which competition is becoming most keen. We hear earnest discussion, in the daily press and in the public speeches, of enlarged trade for New England and the efforts which we must make to gain this trade in the face of competitors. You have felt this keenly in the cotton manufacture, and we in the educational institutions of New England are meeting to-day a competition which is very similar to that which you have met in the manufacture of cotton fabrics.

We had the start of the universities of the west, in the equipment of our technical school, just as you had the start of the cotton mills of the south in the equipment of your mills and the training of your workmen. But in the last few years you have found a great movement springing up, transferring the manufacture of cotton goods from New England to the region in which the cotton is raised; and, in a very similar way, we, in the educational institutions of New England, have found a series of great technical schools growing up in Michigan, Wisconsin, Illinois and other western states, supported generously by the state, and offering constantly increasing facilities to students who formerly thought only of eastern institutions when they contemplated technical training of high character.

I have sometimes been asked why the Institute of Technology should care to draw students from outside Massachusetts and New England, why we should desire to have the student from Missouri, from California, from England, from Australia, from Japan. The answer to this question is clear, and it is this: the presence of students from the whole world in a great institution of learning is the best barometer of its alertness and its efficiency; it is the surest sign of intellectual leadership which an institution can secure. Whenever our great institutions of Massachusetts, when Harvard and the Institute of Technology, cease to attract men from the west and from the south, they will cease to offer to the student of Massachusetts and New England the highest educational attractions. Not only is this true, but in taking men from the whole world one brings in energy and alertness and initiative, as well as gives it out; one adds to the strength and the industrial efficiency of the state and of the region, at the same time that he develops the strength and the industrial efficiency of the more remote regions. A great educational institution is like a great magnet, it grows in strength when it carries its full load.

In appealing to such students, however, the educational institutions of the east find themselves now confronted with what practically amounts to an educational tariff. These great uni-

versities of the west, supported as they are by the state, offer technical and professional education, always most costly to maintain, either free or at very small cost to the student. Thus, in the year 1902, 3,509 students in the University of Michigan paid into its treasury fees amounting to $148,000, and 1,415 students in the Massachusetts Institute of Technology paid fees amounting to $253,000. The difference in the cost to the individual student was made possible by the fact that the University of Michigan received from the state for the expenses of that year a contribution of $450,000. Counting interest at 4 per cent. this is equivalent to endowing the institution with an endowment of more than $11,000,000, which is many times that which the Institute of Technology has.

If we are to retain our leadership and are still to bring to our institutions of learning men from the whole country, if we are to remain national rather than local institutions, I believe it is to be, as the result of much the same process by which you cotton manufacturers have maintained your leadership in competition with those of the south. You have done this by raising the grade of your manufactures, by improved machinery, by intelligent study of your own business, by alertness and initiative, and by providing the best business facilities. If we are to succeed, we must follow the same policy. If education is to be more costly with us, then we must counterbalance cheapness by quality. We must offer facilities which are the best, we must be quick to improve educational methods and open-minded in the development of educational needs, and above all, we must offer to students from other states and other countries the supreme inducement to an earnest student: the presence of great teachers in our institutions. Our leadership in education depends in the end, as does yours in manufacture, on men, and I cannot but believe that New England, which has been so successful in growing men in the past, will be successful in growing them in the future, able to meet the new problems and the new conditions; and I cannot but think that you in manufacture, and we who have to do with technical education, shall stand or

fall together. Either we shall lead in manufacture and lead in technical education, or we shall fall behind in manufacture and in technical education. In every step which the institute has made in the last five years, it has sought to reach down so as to deal with your problems, feeling that your problems were its problems. It has established a department of engineering research, a laboratory of chemical research, an experiment station of sanitary research. Each of these is a distinct effort to deal with the actual problems which confront New England and Massachusetts in important practical directions. May I ask that we may have from you in this effort that support which may enable us to strive onward toward our own leadership in education, — that is to say, a support which will enable us to bring to the Institute of Technology that *sine qua non* of all success, — that is, the presence in its faculty of the ablest, the most efficient and the most productive men whom we can call into its service? [Applause.]

PRESIDENT'S ADDRESS.

HERBERT E. WALMSLEY, New Bedford, Mass.

Gentlemen of the New England Cotton Manufacturers' Association.

As President of this Association, and on behalf of the Board of Government, it is my privilege, and at the same time it affords me much pleasure, to extend to you all, individually and collectively, a very hearty welcome to this the 76th Convention of the Association, with the earnest hope that our deliberations may be of mutual benefit and advantage.

The details of the work of the Association and of its Board of Government are contained in the reports of the secretary and treasurer, to which there is nothing more to be added except to call the attention of the members to two facts; first, that the work of the Association has cost less per unit of page for each member through the past year than ever before.

Attention is also called to the importance of members paying their dues promptly. The greater portion of the expenses of this organization fall due in the first part of the fiscal year, and every bill is promptly met as soon as its accuracy is vouched for and the amount of bills receivable is larger than ever before.

I need perhaps hardly say that individual members cannot divest themselves of their share of the responsibility attaching to their membership in the organization; on the other hand, every member of the Association must feel that he has directly or indirectly some share, some personal interest, not only in the proceedings of these conventions, but equally so in the increased

efficiency, usefulness, and welfare of the Association; its *continued* usefulness and efficiency necessarily depends upon and will be proportionate to the interest taken in its work by the members themselves.

To be connected with the membership of this organization is in every way desirable for those who wish to follow cotton manufacturing as a profession, or who, being already engaged in the business, wish to keep in touch with manufacturing progress.

As you are aware, the purpose of the Association is to render itself aggressively useful to cotton manufacturing interests by affording every facility for interchange of experiences and opinions; in fact, the spirit which has animated the Association since its organization has been largely one of mutual helpfulness, and the aim and effort of its officers has been, and is, to keep its tone high, and to reach out in all directions in the endeavor to encourage the best systems and the best practices in the trade, and to keep correct principles constantly before its members; and, while the Association as an organization devoted to the technics of cotton manufacture has steadily avoided questions of commercialism which are being continually placed before it from all quarters, its functions are strictly limited to the practical side of these problems.

A perusal of the Transactions conveys, far better than words, the important work in which the Association is engaged; these volumes are, in my judgment, invaluable as works of reference; the practical and general all round information contained therein make them, to my mind, a complete and exhaustive technical library in themselves, containing, as they do, able and exhaustive papers — written by able men of long practical experience, — and covering the entire range of subjects pertaining to the industry.

No man connected with, or interested directly or indirectly in the cotton trade can afford to be without them, and I do not hesitate to say that the entire record of the Association since its inception is one of which we may well be proud, and which is

so largely due, I again take pleasure in saying, to the untiring effort and indefatigable work of the Secretary and Treasurer, Mr. WOODBURY.

In my inaugural address at the semi-annual meeting of this Association, held at Lenox last fall, I took occasion to emphasize the fact that, at that particular time, and for some months previous thereto, the cotton manufacturing industry, in which we all have such deep concern, was in a most unsatisfactory and unprofitable condition; I also stated that we were then passing through one of the most difficult and trying periods in the history of the trade, the then prevailing conditions and quietude being intensified by the raw material situation, adding that what had created perhaps the greatest difficulty was not so much the cessation in the supply of the raw material itself, but the temporary cessation of that supply in conjunction with the speculative manipulation of the staple then in progress.

I further remarked that it would be a great boon to the entire cotton manufacturing world if the efforts being put forth to increase the supply of raw cotton in various parts of the world should prove successful, which would, in my opinion, be the case in the course of time.

In what I have to say today in this connection, I, naturally, desire to avoid repetition, but, in venturing to again invite your attention to the foregoing remarks, I do so purposely and intentionally in view of the fact that the situation and the conditions confronting us today are equally as unsatisfactory and unfortunate — if not more so — than when I last had the honor of addressing you, conditions in my judgment, and as I read the situation, due mainly, if not entirely, to the selfsame causes.

I need hardly remind you, gentlemen, that the great cotton manufacturing industry is one of the most important branches of manufacture in this country, in the enormous amount of capital invested in it; the thousands of families dependent upon it for existence; in the amount of wages paid, and in the value of its manufactured products. Ranking second only to the cotton trade of Great Britain in extent and importance, its progress in

this country in recent years is little less than phenomenal, destined probably, in the not very distant future, to lead the world.

This great trade, affecting practically every other trade, is not then a matter of concern to those interested in cotton alone; it is of national magnitude and moment; yet today this great and important national asset is, as it were, trembling in the balance, crippled, paralyzed on account of the scarcity of the white staple, face to face with a cotton famine.

No one who engages in a serious study of this question, and who does not, can resist the conclusion, or fail to grasp the fact that we find ourselves and these vast interests confronted with a problem extremely grave in character and far reaching in extent.

We know, of course, that the fundamental law of supply and demand — the most general and fundamental of all laws — will alone restore the equilibrium, but here again, and in the meantime, we are confronted with the labor problem, the undoubted and unquestioned scarcity of labor in the cotton fields; this is the dangerous element dominating the entire outlook, which aspect of the situation seems hitherto to have received scarcely any, or rather, we should perhaps more correctly say, sufficient attention; indications, however, fortunately are not wanting that a conclusion of this kind is forcing itself steadily to the front.

In any event, the immediate outlook is sufficiently grave, and it is perfectly evident that we have here all the elements of a problem of capital importance, a problem quite special and entirely different from any before presented.

In view of the immensity of the interests dependent for their prosperity on the Cotton Manufacturing Industry, recognizing and realizing the urgency of the situation, it is imperative to awaken as wide and general an interest as possible in this truly national question; anything which helps the cotton trade is of immense benefit to the whole community; anything which hinders it is a serious disaster. For these reasons no one can view, without the deepest concern, the perilous position in which we find ourselves; the "dead-lock" should make all thinking

men consider very carefully the danger which threatens the industry; owing to the severity of modern industrial and commercial competition, there is no one who can afford to ignore our trade problems.

That the South with its millions of acres of land, its soil and its climate, so well adapted to cotton growing — unequalled anywhere in the world, so far as at present known — is capable of producing sufficient cotton of the required character and staple to supply the requirements of the entire cotton manufacturing world indefinitely, is indisputable.

The planting and marketing of an increased acreage is necessarily limited by labor conditions; nevertheless, it is perfectly clear that, in developing the resources of the Southern Cotton Belt, the last thing to be tolerated is the wasting of the resources of these rich lands through the lack of native labor, or of the qualities of efficiency or effort of the colored people; it will be no part of the future conditions that this shall be allowed to prevent the utilization of the immense possibilities and natural resources of that section of this country; the development of those lands is one of the most pressing questions engaging the attention of the cotton world. All else sinks into insignificance when contrasted with the difficulty presented, which difficulty probably accounts, to a large extent, for the present "deadlock."

It is essential to the interests of the United States as producer, manufacturer, and exporter of cotton that the supply from our fields be increased, and its cost reduced, so as to retain this enormous source of wealth to the United States.

The labor problem will, of course, be solved sooner or later, and it would appear, from what we are told, that the relief may come through immigration from Southern Europe; the growing tendency of Italian immigrants to seek homes in the Cotton Belt, it is suggested, may be a means of overcoming the difficulty; we are assured on authority that, as growers of cotton, the Italians are in every respect equal, if not superior to the negro; the tide of such immigration will probably flow in that direction if attracted by prospects of betterment.

The economic necessity may become so pressing, however, as to justify and even demand the importation of some form of Asiatic labor; say, for instance, Japanese.

We may be opposed to yellow labor and perhaps nothing but the averting of a positive catastrophe, or of a continued grave industrial and commercial crisis, would justify its advocacy; nevertheless, we must look the situation in the face as we find it, and act accordingly.

It is hardly possible to gauge how much the shortage of cotton and gambling in cotton have injuriously affected the trade; it is utterly impossible to estimate the money loss, not only to the stockholders, but to the operatives, through lack of a sufficient cotton supply; the progress of the industry is hindered and retarded, and business is impeded.

After all, the operatives are the chief sufferers, many of them through short time able to earn barely enough for bare existence, and many others able to earn absolutely nothing through the complete stoppage of mills and machinery. Such a situation is intolerable.

How imperative then it has become that more cotton be grown and marketed so that once more there may be a steady trade with ample employment for all; it has become absolutely necessary to the general welfare to have an increasingly prolific supply from which to obtain the raw material; it is only thus we shall be safe from panics whenever deficient crops are threatened.

Again there is an enormously increased and ever increasing demand for cotton over and above the cotton now being grown; it is perfectly evident that the supply is considerably short of the established demand; this is the serious and impressive fact of the situation; high prices for the raw material are, therefore, plainly inevitable, with the situation intensified and aggravated for the manufacturer by the speculator, and the only possible or practicable remedy is by increasing the supply of the staple.

However much we may and do deplore gambling in cotton, and however much we may and do condemn the deplorable

practice, as practical men we must meet and face the issue in a practical manner; the trade will never be free from unduly high prices, speculation, and unsatisfactory and harmful fluctuations until there is an ample supply of the raw material, a supply obviously equal to the demand, this is in reality, and as a matter of fact, the only possible cure for stagnation of trade, with its terrible consequences to all, and will alone prevent, to a great extent, the pernicious traffic of "cornering."

Some 60 per cent. of the raw cotton produced in the world is grown in the United States, and the cotton manufacturers of this country are requiring a continually increasing share of it; this fact and the phenomenal rise in the price of cotton which has taken place during the last year has aroused the cotton manufacturing interests of other countries to a very lively realization of their critical and dangerous position, and their dependence upon the United States for the raw material; hence, the vigorous and determined efforts being made by them to supply the deficiency from sources other than the United States. Again, however well a mill may be organized or competently managed, the results will not be satisfactory if the price of raw material exceeds its just ratio to the manufactured product.

Both of these have their legitimate fluctuations coinciding with the laws of supply and demand, and in all equity these variations in prices should be concurrent.

There is such a variety in the output of cotton goods that their consumption is absorbed by various markets, and this diversity eludes attempts at control.

But, during the past year, there have been attempts to vary the price of cotton wherein alternate success and failure to control the market has caused the quotations to exceed and to be less than its probable legitimate value.

As long as there are men in control of sufficient funds for the purpose, so long will standard products in the market be subject to both purchase and sale in abnormal quantities, beyond the existing demand for consumption, for the purpose of raising and depressing the market prices.

Prices of goods respond far more readily to a depression in the market price of cotton at the time of the output than they do to an advance in the price of the raw material, although this cotton must have been purchased for the purpose of manufacture months before.

No manufacturing process, when considered as a whole, can ignore the prices of raw material and of the manufactured product in the consideration of the final results governing the work of a mill manager.

Owing to the scarcity of the raw material, prices for the staple have been greatly inflated.

It is imperative, in order to reach a level from which a great forward movement in the cotton trade can be started, that there should be a decline in the price of raw material to a more reasonable and equitable basis; still, with the crop insufficient even for a reduced consumption, there is not much prospect of a low level of quotations for raw cotton to invigorate the demand for yarn and cloth.

I do not hesitate to express what I believe to be the general opinion, and that is that there would at the present time be a satisfactory trade in cotton goods if the raw material could be had at a reasonable price; in fact, there is every indication that this would be the case.

Fully realizing that we are in the midst of most trying times, and while it would be nothing less than folly, suicidal, to attempt to minimize the extreme and urgent gravity of the general situation, I do not look perhaps with such dismay as some people upon the future; rather, I would venture to predict, and prefer to believe, that the result of the disastrous twelve months we have passed through, the result of the shortage of cotton, the result of the speculative manipulation of cotton will ultimately prove to be a blessing in disguise for the entire manufacturing world, and all of which must needs act as a strengthening and bracing influence in the work before us; a definite stage has been reached, and we now see clearly the direction through which alone relief is possible.

After the protracted period of depression, discouragement, and loss through which we have passed, necessitating extensive curtailment of production, with, as a natural consequence, depleted stocks of manufactured goods all over the country, it is not unreasonable or over sanguine to anticipate in the near future a revival of trade at remunerative prices, with machinery in full operation, and that once again we may enter upon a period, a prolonged period, let us hope, of prosperity.

In passing, I venture to again invite your attention, as I did at Lenox, to the question of a more nearly uniform and maximum labor day in every state in the Union, and which I now take the opportunity of still further emphasizing, and which, it would seem, there should be concerted and determined effort to establish.

Where the law is rigidly enforced and lived up to, as say in Massachusetts, the manufacturers are put to severe and unjust competition with mills and factories in other states wherein longer working hours are exacted, and only the same and in many cases less wages are paid.

If the 58 hour a week law is enforced in the factories and workshops in Massachusetts, it should certainly and in all equity become law in the other states of the Union.

Imaginary state lines are not observed in industrial competition. The 58 hour law in Massachusetts is a detriment to employers and employed here if 60 hours or more constitute a week's work in any other state, 66, I believe, is the average in the South.

The margin of profit in cotton manufacturing, taking year in and year out, is nowadays so small that such a difference as exists in working hours in different states, more especially, of course, as between North and South, is enough to compel a move to the states of longer labor days, or else go out of business.

It may be a long time ere a uniform working day or week is established throughout this broad land, but, when the necessity for it is realized, it is but a question of time when it will surely and inevitably come.

This is a national question and should be discussed calmly, intelligently, and impassionately, without fear or favor.

Among the subjects of vital interest to the New England cotton manufacturer, which with proper attention would tend to solve the problem of constantly recurring periods of depression in textile industries, is that of our export trade in cotton yarns and fabrics.

In my address at the last semi-annual meeting I briefly referred to this subject, but further thought and investigation of textile statistics convinces me that my reference was too brief, and might legitimately be made more emphatic.

The United States largely supplies the world with raw cotton, producing over 60 per cent. of the world's cotton crop.

In the year 1901 the value of cotton, cotton oil, and cotton products exported from this country reached the enormous total of over $365,000,000, an average of over $1,000,000 per day.

Of this total $313,000,000 represented raw cotton, while manufactured products of cotton in the same period were exported to the relatively insignificant value of $20,000,000.

A further analysis of these figures shows that approximately 3,500 million pounds of raw cotton were exported in that year at an average price of about 9 cents per pound, and that about forty times as much cotton was exported in the raw state as in the manufactured state.

The raw cotton exported is manufactured into goods in other countries, and the bulk of it re-exported by these manufacturing countries to their customers in all parts of the world.

What a world of possibility is opened up to the American cotton manufacturer!

If only one tenth of this vast amount of raw cotton that is exported at 9 cents a pound could be manufactured in America, and exported in the form of cotton cloth at an average of twenty-five cents per pound, which is a low estimate, it would add $56,000,000 to the value of our cotton exports each year.

This amount of money would remain in the country in the form of wages for the operatives, payments for machinery or

mill supplies, profits to the manufacturer, and permanent monuments of increasing prosperity in the form of additional textile mills and machine works, and yet this represents only ten per cent. of the extreme possibility shown by statistics of our exports.

The statistics of international commerce of manufactures show that out of the total amount of cotton goods entering into the commerce of the different countries less than six per cent. is manufactured in the United States, and we are yet but feeling our way in exporting cotton goods.

The consumption of such thickly populated countries as India, and the imports into the vast territories of Africa and South America, the markets of which are yet to a large extent undeveloped, do not even show the effects of any American competition.

China is the only market in which any impression has yet been made by the American exporter of cotton cloth.

Undeveloped territory alone would provide an immense market for American products without interfering with existing international commerce of other countries.

At the last semi-annual meeting a resolve was passed that the good offices of the Departments of State and of Commerce and Labor be solicited with a view to obtaining available information regarding possible markets for American cotton goods of all descriptions, including cotton yarns, and it seems to me that the influence of every member of this Association should be brought to bear on their representatives in Congress towards requiring that attention be given by the above-named Department and the United States Consular Service throughout the world in the direction of furthering the opportunities of increasing our export trade in cotton goods.

The ultimate benefit to our industry will, however, depend upon ourselves as manufacturers to produce those fabrics which meet the needs of the foreign customer, differing in many important respects from those suited for domestic trade.

It will depend on our treasurers, commission houses, and merchants in that they shall study the commercial conditions existing in foreign markets, and adapt our methods to suit the customers. The reward is worthy the effort.

The building up of a permanent export trade on a sound basis will insure, more than anything else, a continuance of prosperity to the cotton industries of the country and prevent the recurrence of periods of trade depression and temporary stagnation, which occur at intervals of a few years, and hang like a cloud over the industry.

Gentlemen. The advance in the cotton trade to its present magnitude is due very largely to the vast improvements which have been made in mills and machinery, in engineering and constructive operations, which have effected more for the industries and commerce of this country during the last decade than has been realized in any previous period; the rapid progress which is being made is such as to render obsolete methods which a few years ago represented the highest and best practice, and it is necessary to be constantly unlearning or revising what one knows.

Improved tools and labor saving machinery are rapidly rendering the manual skill and dexterity of the individual workman of minor significance; the great industries of today depend more and more upon the successful application of modern discoveries and inventions, and less and less upon the presence of coal, iron and raw materials.

In the industrial race in which we are engaged, scientific knowledge and its ready application to the needs of the manufacturer indicate the direction in which we are travelling.

The marvellous industrial development and unparalled expansion which has taken place in this country, to a degree never before imagined, are amongst the wonders of the present age, and are apparently only the earnest of the future.

No limit can be set to the possibilities of even the near future; the achievements of the past, extraordinary as they

have been, are not improbably destined to be eclipsed at no distant date, and as time goes on.

In the process of expansion which we are undergoing, we are being worked up to a high state of efficiency in the rivalry of life; the spirit of competition, which brings improvement and activity, is keener today than ever before; the resulting energy, activity, vigor, and enterprise of our people has given us the commanding place we have come to occupy in the world.

With our unbounded resources and unlimited capital our future advance and progress, if true to ourselves and our traditions, must be steady, with the onward movement of a people conscious of its strength with no doubt as to the final issue, and, in conclusion, I do not hesitate to say that no other race has ever looked out upon such an opportunity as presents itself before our people in this twentieth century.

ANNOUNCEMENTS BY THE SECRETARY.

The SECRETARY. Mr. President, I have received the following communication:

WHITE HOUSE, WASHINGTON.

The President thanks the President and Directors of the New England Cotton Manufacturers' Association for their courteous invitation to be present at the seventy-sixth meeting of the Association, to be held at Huntington Hall, Boston, Mass., April 27 and 28, 1904, and regrets his inability to accept.

I have also received letters from JOHN FRITZ of Bethlehem, Pa., the Nestor of American engineers; from His Honor, Lieutenant-Governor CURTIS GUILD, Jr., and others.

In regard to badges, it is hoped that all will register and obtain a badge, those who are proposed for membership at this meeting to obtain a member's and not a guest's badge, others guests' badges.

The executors of the estate of one of our first members have on sale a number of the early Transactions of the Association, and with those which the Association has been able to obtain from time to time, it is supposed that a perfect set can be made up if any one wishes to make a purchase of such a set. The Association has demands from several public libraries, but it was thought best that the first opportunity should be given to the members of the Association.

The following papers were read:

The Cotton Situation.

THEODORE H. PRICE, 71 Wall Street, New York City.

Discussed by Mr. JAMES R. MACCOLL.

Preparation for Mill Management.

RUSSELL W. EATON, Brunswick, Me.

Discussed by Messrs. ARTHUR H. GULLIVER, WILLIAM D. HARTSHORNE, EDWARD ATKINSON, HERBERT E. WALMSLEY, WILLIAM L. LYALL, J. F. POWERS and E. STANLEY GARY

SECOND SESSION.

WEDNESDAY AFTERNOON, April 27, 1904.

Meeting called to order at 2 P. M., President WALMSLEY in the chair.

The following papers were read:

The Origin of Sewing Cotton.
JAMES CLARK, Chapel House, Paisley, Scotland.

The Spindle Situation.
General WILLIAM F. DRAPER, Hopedale, Mass.

Discussed by Mr. HERBERT E. WALMSLEY.

ANNOUNCEMENTS BY THE SECRETARY.

Mr. PRESIDENT, before we pass on to the next paper I have two or three notices to give, one in regard to the Boston Museum of Fine Arts, which has a special textile collection in the basement, room 14, including many rare mediaeval fabrics, while many laces, tapestries, rugs and velvets are to be seen on the upper floor. They have a great variety, including some of the oldest samples of woven goods which are anywhere in existence.

Mr. EDWARD ATKINSON wishes the attention of the members

called to the sample of the Japanese textile art, woven by hand, which has been placed upon the wall.

Advantages of Rope Transmission in Textile Plants.

FREDERICK S. GREENE, 65 Wall St., New York City.

Discussed by Messrs. EDWARD W. THOMAS, CHARLES R. MAKEPEACE, J. R. MONTGOMERY, SIDNEY B. PAINE and HERBERT E. WALMSLEY.

Our Consuls on Export Markets for Cotton Goods.

EDWARD N. VOSE, 290 Broadway, New York City.

THIRD SESSION.

THURSDAY MORNING, APRIL 28, 1904.

Meeting called to order at 10 A. M., President WALMSLEY in the chair.

The following papers were read:

The Carding Department.
EBEN C. WILLEY, Hope Mills, N. C.

Discussed by Mr. WILLIAM HAYES.

Humidity in Cotton Manufacturing.
GEORGE A. AYER, Easthampton, Mass.

Discussed by Messrs. FRANK B. COMINS, FRANK W. WESTON and C. E. W. DOW.

Roving Traverse Motion on Fly Frames.
LOGAN OWEN, Macon, Ga.

Discussed by Mr. JOHN TEMPEST MEATS.

The Thomas Universal Yarn Assorting Balance.
GEORGE THOMAS, 72A Deansgate, Manchester, England.

In response to the invitation extended by President PRITCHETT a large delegation of the members were present in

Huntington Hall at 2 P. M. to listen to the address delivered to the students of the Institute by Mr. JACOB RIIS of New York on the subject "My Philosophy of Life." All who were present enjoyed the stimulating and vigorous thought expressed in the speaker's remarks.

FOURTH SESSION.

THURSDAY AFTERNOON, APRIL 28, 1904.

Meeting called to order at 2.30 P. M., President WALMSLEY in the chair.

ELECTION OF MEMBERS.

The PRESIDENT. Gentlemen, if you will come to order we will proceed with the business of the last session. The first business is the election of members, and the Secretary will distribute the list which has been printed and which has been approved by the Board of Government in accordance with the By-laws. I will appoint as a committee to receive, sort and count the ballots Mr. WILLIAM F. SHERMAN, Mr. GEORGE OTIS DRAPER and Mr. HENRY C. DEXTER, which committee, of course, will report later.

The list of names on the ballot was read by the Secretary as follows:

FOR ACTIVE MEMBERSHIP.

ADAMS, WILLIAM P., Supt. Pittsfield Mills, Pittsfield, N. H.
By GEORGE E. KENT.

AHMUTY, JAMES W., Supt. Atlantic Cotton Mills, Lawrence, Mass.
By WALTER H. SUMMERSBY.

BARBOUR, J. E., Pres. Barbour Flax Spng. Co., Paterson, N. J.
By WILLIAM L. LYALL.

BROADBENT, JAMES T., Instr. Carding and Spinning, Bradford Durfee Textile School, Fall River, Mass.
By J. W. BAILEY.

BULLOCK, E. R., Mech. Eng., J. & P. Coats, Ltd., Pawtucket, R. I.
By J. R. MACCOLL.

CARTER, HORACE P., Agt. Edwards Mfg. Co., Augusta, Maine.
By R. W. EATON.

CHADWICK, ALFRED M., Asst. Agt., Tremont & Suffolk Mills, Lowell, Mass. By J. J. CONNELL.

CROMPTON, GEORGE, Treas. Wachusett Mills and member firm Crompton-Thayer Loom Co., Worcester, Mass.
By HERBERT E. WALMSLEY.

FINOCCHIARO, EUGENE, Asst. Supt. Cohannet Mills, Taunton, Mass.
By JESSE A. KNIGHT.

FUKUHARA, HACHIRO, Kanegafuchi Spin. Co., Hiogo, Japan.
By C. H. FISH.

GREENE, EDWIN FARNHAM, Asst. Treas. Dwight Mfg. Co. and Pres. Lockwood, Greene & Co., Boston, Mass.
By J. HERBERT SAWYER.

HATCH, CHESTER D., Supt. Exeter Mfg. Co., Exeter, N. H.
By GEORGE E. KENT.

HERSOM, ARTHUR N., Asst. Supt. Tremont & Suffolk Mills, Lowell, Mass.
By J. J. CONNELL.

HOPSON, H. B., Supt. Spool Cot. Dept., Bibb Mfg. Co., Macon, Ga.
By SAMUEL M. GREEN.

LORD, JOHN T., Supt. Pacific Mills, Lawrence, Mass.
By WALTER E. PARKER.

MCALLISTER, ANDREW W., Supt. Natick Mills, Natick, R. I.
By ARTHUR F. BRACKETT.

ORR, WILLIAM B., Supt. Renfrew Mfg. Co., Adams, Mass.
By EMIL KIPPER.

OWEN, LOGAN, Supt. Mlll No. 1, Bibb Mfg. Co., Macon, Ga.
By W. H. RICHMOND.

PERKINS, HADLEY D., member of firm Sharp, Perkins & Co., Woonsocket, R. I.
By H. S. HOUGHTON, Sr.

RICKETSON, HARRY J., Supt. Merchants' Mfg. Co., Fall River, Mass.
By JOHN H. HOLT.

ROWE, HENRY, Mgr. Aurora Bleachery & Dye Works, Aurora, Ill.
By ARTHUR PARKINSON.

SANDERSON, J. N., Agt. Renfrew Mfg. Co., Adams, Mass.
By ERNEST L. HILL.

SOULE, RUFUS A., Pres. Soule Mill and City Mfg. Cor., New Bedford, Mass. FREDERICK B. MACY.

STONE, HENRY WM., Supt. Holliston Mills, Norwood, Mass.
By FREDERICK I. DANA.

WIGHT, R. W., Asst. Treas. Indian Orchard Co., Indian Orchard, Mass.
By WM. C. GODFREY.

FOR ASSOCIATE MEMBERSHIP.

BUTLER, ARTHUR CECIL, Agt. for E. A. Leigh, 232 Summer St., Boston, Mass. By E. A. LEIGH.

CROMPTON, RANDOLPH, member firm of Crompton-Thayer Loom Co., Worcester, Mass.
By HERBERT E. WALMSLEY.

DANKER, DANIEL J., member firm of Danker & Marston, Importers of dyestuffs and chemicals, 247 Atlantic Ave., Boston, Mass.
By D. M. BATES.

FOWLER, W. F., Mgr. Baltimore office Westinghouse Elec. & Mfg. Co., 221 North Calvert St., Baltimore, Md.
By JNO. H. C. CHURCH.

IRESON, CHARLES L., Belt Mfr., 148 High St., Boston, Mass.
By ROYAL W. GATES.

LAWRENCE, JOHN H., Top Roll Mfr., New Bedford, Mass.
By FREDERICK B. MACY.

LEVALLEY, FRANK A., Cotton Broker, Fall River, Mass.
By FREDERICK B. MACY.

MANSON, D. EDGAR, Agt. Westinghouse Elec. & Mfg. Co., 131 State St., Room 716, Boston, Mass.
By JNO. H. C. CHURCH.

MARSTON, JOHN P., member of firm Danker & Marston, 247 Atlantic Ave., Boston, Mass.
By DANIEL MOORE BATES.

OLDFIELD, JOHN, Mechanical Engineer, Beacon St., Everett, Mass.
By HERBERT E. WALMSLEY.

O'KEEFE, THOS. J., Mgr., Charles L. Ireson, 148 High St., Boston, Mass. By OSCAR B. TRUESDELL.

PRAY, CHARLES F., Cloth Broker, 72 Leonard St., New York, N. Y.
By FREDERICK B. MACY.

REYNOLDS, FRANK W., Member firm Lockwood, Greene & Co., Boston, Mass. By EDWARD FARNHAM GREENE.

SCOFIELD, WILLIAM B., member firm of Crompton-Thayer Loom Co., Worcester, Mass.
By HERBERT E. WALMSLEY.

SHURTLEFF, LEWIS T., Manager Paper Department, Pairpont Corporation, New Bedford, Mass.
By GEORGE A. AYER.

TAYLOR, ROBERT, Jr., Mgr. Asa Lees & Co., Ltd., Oldham, England.
By WILLIAM FIRTH.

Mr. ARTHUR H. LOWE. Mr. President, I move that the Secretary be requested to cast one ballot for the names that are on this list. I do this to expedite business and also that the members may retain the lists they have, which I have no doubt they will be very glad to do.

The motion was seconded and being put to vote was declared unanimously carried.

The SECRETARY. Mr. President, in accordance with that vote, that list of names is my ballot.

The PRESIDENT. The Secretary has cast one ballot for the names recommended for membership by the Board of Government, and they are therefore unanimously elected.

ELECTION OF OFFICERS.

The SECRETARY. Mr. President, I have here the report of the Committee on Nominations, which they have had printed and placed in my hands:

REPORT OF NOMINATING COMMITTEE.

BOSTON, April 28, 1904.

To the Members of the New England Cotton Manufacturers' Association,

The Nominating Committee have attended to the duty assigned them and report the following nominations:

PRESIDENT.

HERBERT E. WALMSLEY, NEW BEDFORD, MASS.

VICE PRESIDENTS.

WILLIAM D. HARTSHORNE, LAWRENCE, MASS.

JAMES R. MACCOLL, PAWTUCKET, R. I.

DIRECTORS TO SERVE THREE YEARS.

GEORGE A. AYER, EASTHAMPTON, MASS.

CHRISTOPHER P. BROOKS, NEW BEDFORD, MASS.

Respectfully submitted,

BYRON F. CARD,
CHARLES W. DENNETT,
WILLIAM H. LOFTUS.

The PRESIDENT. Gentlemen, the committee appointed yesterday to bring in a list of candidates for offices for the ensuing year having made its report, the ballots are now ready and will be distributed and the ballot will be taken at the present time.

Mr. WALTER E. PARKER. Mr. President, I move that the report be accepted.

The motion was seconded and carried.

The PRESIDENT. Will the same committee be kind enough to distribute the ballots, the same committee that distributed the ballots previously?

The Committee proceeded to discharge their duty and distributed the ballots.

Mr. J. R. MONTGOMERY. Mr. President, I move that the Secretary be empowered to cast one ballot for the officers recommended by the Nominating Committee, to expedite the business.

The motion was seconded and, being put to vote, was declared unanimously carried.

The SECRETARY. Mr. President, I cast this as my ballot:

For President, HENRY E. WALMSLEY of New Bedford, Mass.

For Vice Presidents, WILLIAM D. HARTSHORNE of Lawrence, Mass., and JAMES R. MACCOLL, of PAWTUCKET, R. I.

For Directors to serve for three years, GEORGE A. AYER of Easthampton, Mass., and CHRISTOPHER P. BROOKS of New Bedford, Mass.

The PRESIDENT. Gentlemen, you have heard the report. The same having received the required number of votes, I now declare them elected as officers of this Association for the ensuing year.

RESOLUTION OF THANKS.

The SECRETARY. The following resolutions are offered by a committee consisting of Messrs. ARTHUR H. GULLIVER, JOSEPH MERRIAM and WILLIAM L. LYALL, appointed by the

President to draft resolutions of thanks for the courtesies received at this meeting.

Resolved, That we, the New England Cotton Manufacturers' Association, in convention assembled, appreciating the courtesy of the Massachusetts Institute of Technology, tendered through its president, Dr. HENRY S. PRITCHETT, in furnishing to us the use of Huntington Hall for our sessions, extend our most hearty thanks.

Resolved, That the hearty thanks of the organization is also extended to the Boston Museum of Fine Arts for their courteous invitation, and to Mr. JAMES CLARK, Chapel House, Paisley, Scotland; Mr. EDWARD N. VOSE, New York City; Mr. GEORGE THOMAS, Manchester, England; and Mr. B. H. THWAITE, London, England; for the very interesting and instructive papers presented at these sessions.

On motion, duly seconded, the foregoing resolutions were unanimously adopted.

The following papers were read:

Gas Power Applied to the Textile Industry.
B. H. THWAITE, 29 Great George Street,
Westminster, London, S. W. England.

Discussed by Messrs. C. J. H. WOODBURY and EDWARD ATKINSON.

Approximate Cost of Mill Buildings.
CHARLES T. MAIN, Boston, Mass.

The Electric Transmission of Power.
EDWARD W. THOMAS, Columbia, S. C.

Discussed by Messrs. SIDNEY B. PAINE and EDWARD ATKINSON.

THE PRESIDENT. Gentlemen, before we adjourn I desire to say how deeply I appreciate the honor the convention has conferred upon me by re-electing me president of this Association for the ensuing year. I need hardly say in accepting the honor

that I stand prepared and ready to give to the Association and its best interests the best that is in me, and in conjunction with my colleagues on the Board of Government and with the invaluable assistance of the Secretary and Treasurer, prepare to still further increase the use, the scope, the influence and the power of the organization in which we all have one common interest.

Gentlemen, there being no further business before the meeting, I now declare the seventy-sixth convention of the New England Cotton Manufacturers' Association adjourned, *sine die.*

(Adjourned at 4.25 P. M.)

Attest:

C. J. H. WOODBURY,

Secretary.

TRANSACTIONS.

FIRST SESSION.

WEDNESDAY MORNING, APRIL 27, 1904.

The Association met in Huntington Hall, Boston, at 11 A. M., President WALMSLEY in the chair.

THE PRESIDENT. The first paper in order, gentlemen, is by one of the most prominent figures and striking personalities in the cotton world, Mr. THEODORE H. PRICE of New York City, the subject, "The Cotton Situation." [Applause.]

Mr. THEODORE H. PRICE. Gentlemen, it was with a good deal of diffidence that I accepted your secretary's invitation to come here, and now after the very able speech of your president I confess it is with a feeling of absolute humility that I come up on this platform and attempt to say anything more about the cotton situation than he has said, he has covered it so ably and so conclusively. At the same time, I have written a paper here and it is your destiny to have it inflicted upon you and mine to read it.

THE COTTON SITUATION.

THEODORE H. PRICE, 71 Wall Street, New York.

When I received from your Association an invitation to speak to-day upon the "Cotton Situation," I am frank to say that although I greatly appreciate the compliment and the opportunity of appearing in person before such an intelligent and influential audience, I hesitated as to whether I ought really to accept. The tremendous scope of the subject with which I was asked to deal appalled me as I came to think over it, and the main difficulty that confronted me in my attempt to prepare this paper, was not how much I might say, but how little I should say. I may therefore re-assure you by telling you in advance that this address has been prepared in a most considerate spirit and that despite the temptation to discursiveness which the subject presents I shall endeavor to follow the practice of the Planters and American Cotton Companies, and compress my remarks within a package of the greatest possible density.

I cannot, however, resist the opportunity of inflicting upon you a short story which exemplifies in hyperbole the American spirit. As many of you perhaps know, it is the practice of the American Ambassador in Paris to give each year on the 4th of July, a dinner to expatriated Americans there. The particular dinner of which this story is told was held during Blaine's term as Secretary of State, at which time you will perhaps recollect, he exploited very vigorously his ideas of a Pan-American Coalition, which was to include in a loose form of political association all the countries of the Western Hemisphere, and was expected to result in greatly extending our trade with Latin

America. At this dinner were two set toasts, "To the President of the United States" and the other "To the United States." The toast to the President was drunk without special incident and the toast-master then proposed "The United States, the Greatest Country of the World, the Heir of all the Ages and the Hope of Humanity for the Future, 'Whose Boundary Extends from Canada on the North to Mexico on the South and from the Atlantic on the East to the Pacific on the West.'" A gentlemen just below got up and said "In the spirit of broader Pan-Americanism, which obtains in the Western Hemisphere at present, may I somewhat modify that toast and propose, rather than the United States, America the entire Western Continent, whose boundary extends from the Arctic on the North to the Antarctic on the South, and whose Western coast is the Eastern shore of the entire Pacific Ocean, and whose Eastern coast is the Western shore of the entire Atlantic Ocean." He had but finished when a man from Chicago arose and said: "Ladies and Gentlemen, I object to them there boundaries. Here's to America bounded on the North by the Aurora Borealis, on the South by the infinite precession of the equinoxes, on the West by primeval chaos and on the East by the Day of Judgment."

So, gentlemen, it seems to me it is with the Empire of Cotton, or rather I should say, perhaps, with the Republic of Cotton, for as some recent experience has shown, he who aspires to be a "cotton king" is liable to very speedy decapitation at the hands of those he would attempt to govern with anything like an autocratic rule.

It is, therefore, a very limited phase of the cotton situation that I must to-day discuss, and that department of the subject which seems to me most germane is the problem with which the American manufacturer is confronted in the apparently abnormal relationship existing between the cost of the raw material and the price of manufactured goods. In approaching this phase of the subject, it is well for us to bear in mind that the increasing quantity of cotton consumed in America as com-

pared with that which is exported, puts our American manufacturers in a position of increased advantage as compared with the one they held a generation ago. To-day America consumes approximately 45 per cent. of the cotton she produces. A generation ago the American consumption was hardly 25 per cent. of the cotton produced here. Under these conditions the American manufacturer is, of course, increasingly independent of European competition in the sale of his goods so far as our home market is concerned, and to that extent is collectively the master of his own commercial destiny. The increased American consumption of cotton and the manufactures of cotton has, on the other hand, its disadvantages. There is no country in the world in which the population is, in times of prosperity, such extravagant buyers, and there is in consequence no country in the world where the reaction from prosperity to hard times and from extravagance to economy is so acute. It follows, therefore, that the elasticity of the American demand for cotton is probably greater than that of any other community in the world, and as conditions of instability are always disadvantageous to organized industry, it seems to me that one of the great difficulties with which you, gentlemen, are confronted, is this very elasticity and uncertainty in the demand for the product of your industry. Such a situation in the goods market we are now apparently facing. It has become of late a theory of mine that in America the extravagant habits of our people induce in times of prosperity the purchase of shirts, sheets, frocks and tablecloths, as the case may be, which, assuming that prosperity were to continue, would be used let us say, for one year, whereas, if these purchases were made at the end of a period of prosperity, the succeeding depression and its forced economies would lengthen the life of the same shirts, sheets, frocks and tablecloths by 50 per cent., or say to eighteen months, thus diminishing by 33 per cent. the demand for cotton goods in the succeeding year. These figures as to the life of the goods are purely theoretical so far as my present knowledge is concerned, but they serve to illustrate my point, and I shall very much

appreciate it if you will inform me in the debate which I understand is to follow whether it is well taken. If so the present depression in the dry goods trade and the apparent apathy in the demand for goods, notwithstanding the curtailment in the production so generally in progress, and the "Campaign of Education" for higher prices in cotton which has come to such an inglorious *denouement* is explicable, and may be regarded as permanently a factor with which the controlling minds of the industry must deal until the cycle of commercial reaction, upon which we seem to be entering, has ended and the purchasing power of the masses has again commenced to climb the ascending scale. If this be so — and the theory is suggested rather as an interrogatory than as an assertion of fact — it is evident that the manufacturer is at present confronted with a proposition as difficult as that of dividing ten by two and obtaining four for a quotient. Unless nearly all those manufacturers, whom it is my good fortune to know, have misled me, I am certain that cotton at 14 or 15 cents per pound cannot be turned into goods to be sold at present prices at a profit. It has been a favorite theory widely exploited by those who have been the apostles of higher prices for cotton that "the mills must have cotton at any price," and that even though on its face the manufacturing business paid a loss, this loss would be cheerfully borne and activity continue unabated because the cotton manufacturer could not afford to disorganize his business and disperse his help by stopping. It has all along been my theory that the manufacturer has succeeded by virtue of his clearness of mathematical vision, and, although he might for a brief time accept a loss when his confidence in an ultimate profit was great, that he would not long submit to the dictation of those who thus attempted to rob him of the fruits of his industry, and that when he resorted to the remedy of stoppage or curtailment, which he is always reluctant to use, this remedy would be so heroically applied as to extirpate for some time the trouble which had made resort to it necessary.

In speaking thus please understand that I am not here to widen the breach, real or imaginary, which is assumed by some authorities to exist between the producers of cotton and the purchases of the raw material or between the planters and the manufacturers. It is my purpose to treat the subject in an entirely academic spirit. Personally I do not believe that there is any real antagonism between the producers of the raw material and the manufacturers. Mistaken speculative movements, such as the one that is now in process of partial liquidation, do not in my opinion, in the long run greatly profit anyone. Seventy per cent. of the cotton crop of the South has passed out of the hands of the producer of it by the first of December and the planter has profited but a little this year by the advance in prices over eleven cents a pound. It is toward the speculator rather than the producer, therefore, that the corrective of short time or curtailment must be applied, and although, if you will pardon a personal allusion, I may be regarded possibly as a representative of the very class whom I would censure, I believe that I have learned one lesson well, and that is, that the law of supply and demand is bigger than the individual, and that whenever an attempt on a large scale is made to mulct the profits of an important industry or business, influences are set in motion which will ultimately and inevitably react upon the author of such an attempt; and that success in speculation is only possible to him who follows rather than attempts to force the operation of this law.

In no trade that I know of is the operation of the law of supply and demand as speedily or as plainly evident as in the cotton trade. The very compressibility and completeness of its statistics, and the fact that the crop must be moved from the plantations to the mills before it is consumed, enables one almost to "mark time," so to speak, with the progress or the retardation of the demand. A celebrated English statesman is said to have remarked that there were three forms of untruthfulness, "the lie, the damn lie, and statistics," but it is almost impossible for me to avoid here giving you a few figures. So

far as the cotton trade is concerned, statistics are not misleading if dealt with with due regard to the nature of the facts of which they are the exponent. The mistake, in my opinion, that is made by most students of cotton statistics is, that they are assumed to be of a prophetic rather than of a historical nature. Statistics are not prophetic; they are simply a record of facts, but we cannot read the future except in the light of the past.

The light crop movement at present is regarded as indicative of a complete exhaustion of Southern supplies. I am not here to indulge in doctrinaire assertions of opinion, but I would call your attention to the fact that oftener than otherwise the course of the market which is, so to speak, the finger upon the dial that indicates the tension of the demand, shows that relatively small receipts of cotton are more likely to reflect an absence of demand than an exhaustion of the supply. Upon no other theory can the course of the market during the last sixty days be explained. Its great advance was had during the period of large receipts. These receipts resulted from the previous purchases of spinners. Your own purchases, gentlemen, for in the last analysis you, or the demand for manufactured goods which you represent, are the arbiters of prices. Under present conditions of handling and transportation in the South probably at least a month upon the average, elapses between the day upon which cotton is bought at the South from planters or the country merchant in a little interior town upon spinners' orders and that at which it appears at the outport and is counted as a portion of the receipts from day to day. Probably ninety days elapse between the time at which cotton is similarly bought for export and its disappearance in the mills of the European manufacturer. It follows, therefore that the influence of prices upon the movement is not apparent for from thirty to ninety days after a preknowledge of the situation has actuated the mind of the ultimate buyer, namely, yourselves, and it is for this reason that I refer to port receipts as historic rather than prophetic in their value as a guide. The season which is coming to an end is a case conspicuously in point. The single in-

fluence that had more effect in engendering this year's great speculation in cotton than any other was the Government report of December 3rd. Cotton did not pass twelve cents a pound for middling until the third day of December, the date of the Government report. At 12 cents a pound we were told that spinners could not and would not buy except on a very reduced scale and yet during December receipts and shipments to the mills continued on a scale which enabled the advocates of higher prices for cotton to say, with apparent truth, that at 13, 14 and 15 cents the demand for cotton was unchecked. The truth, however, became apparent in about 30 days, and since the first of January the receipts have shown rapid diminution, while the exports of cotton since that date are the smallest on record for the past ten years and over 1,000,000 bales less than they were during the corresponding period last year. But, watch the action of the market, which, as I said a moment ago, is the dial hand which marks the intensity of the demand. The speculative impulse that it acquired sufficed to carry prices to over 18 cents for the July position in New Orleans on the first of February, when despite the commencement of the rapid falling off in receipts prices began to decline and have since that time intermittently tended toward a lower level. It is obvious to my mind, and I think it will be to yours upon reflection, that prices advanced in the face of large receipts because spinners were buying, and that the large receipts represented cotton which had been bought and was being shipped to them, and that prices declined in the face of small receipts because you gentlemen had stopped buying and the speculative demand, which is necessarily anticipatory of what will be your action, was not able to support the market.

I have gone thus exhaustively into a consideration of the facts which are from time to time being discussed by the trade, because it seems to me they so forcibly emphasize the tremendous power which the American spinner is in a position to exert in restraining immoderate speculation and establishing a stability of values.

There are one or two other factors the operation of which usually escapes observation, but which seem to me to have been especially apparent during the cotton season now drawing to a close.

To one of these I shall briefly advert: It is the Oriental demand for cotton goods of Occidental manufacture, which cannot be intelligently studied without co-ordinately considering the importance, extent and history of the production and manufacture of cotton in East India, China and Japan. While statistics as to the production and manufacture of cotton in India have been during the later years of English occupation fairly well kept, but little is known of the quantity of cotton produced in China. It is an historical fact of some interest in this connection that the earliest mention of cotton culture is associated by Herodotus with East India and China. According to the latest figures I have been able to obtain, the population of China is 426,000,000, and of Korea, Tonquin and other Mongolian countries about 44,000,000. The population of East India is 232,000,000. Here, therefore, is an aggregate of about 700,000,000 of people whose principal clothing, where they wear any, consists of cotton textiles. I find that according to the monograph upon "Commercial India" (p. 1680), issued by Mr. O. P. AUSTIN, of the Bureau of Statistics at Washington, the total value of all importations of cotton goods and yarns into East India in the year 1902 was "about $100,000,000." According to the same authority in the monograph upon the "Commerce of China" (p. 2964), the total value of all classes of cotton goods and yarns imported into China in the year 1897 was $56,588,635. Of these imports $19,000,000 came from India and were composed, presumably, of the product of East Indian cotton, leaving $37,000,000 as the net value of the cotton goods manufactured from American cotton and imported into China. An inspection of such other authorities as I have access to upon the subject of Oriental commerce leads me to the conclusion that $150,000,000 is a full estimate of the value of the goods composed of American cotton exported to what is known

as the "Pacific Orient," *i. e.*, China, East India, Korea, Tonquin and the Strait Settlements. Japan is not included in this estimate, as it imports directly a large quantity of American cotton. This total of $150,000,000 is the valuation of the finished product, the cost of which is represented approximately, by labor and cost of manufacture, 50 per cent., transportation, 10 per cent., profits of manufacturers and costs of selling, 10 per cent., leaving the average value of the raw material contained therein about 30 per cent., or say, $45,000,000, equal, at average prices, to about 900,000 bales of cotton. This is little less than 10 per cent. of the American crop. As the total population of Continental Europe, Great Britain and North and South America is only about 450,000,000, it is evident that nine-tenths of the Americon crop, or, let us say, 9,500,000 bales of cotton, plus about 2,500,000 bales of Egyptian and East Indian cotton, imported to Europe and America from these two countries (or 12,000,000 bales in all), are consumed in clothing 450,000,000 of people. As above pointed out, the population of East India and China, etc., is 700,000,000. If, therefore, it requires 12,000,000 bales of cotton to clothe 450,000,000 Europeans and Americans, it is plain that the 900,000 bales of American cotton exported in the form of manufactured goods to East India and China from Europe and America, cannot go very far toward clothing a population of 700,000,000.

A logical deduction from the foregoing figures, and one from which there seems to me no escape, is that the cotton production of China and Korea, concerning which no statistics are kept or obtainable, is very much larger than we of the Western world have any idea, and that the Oriental demand for cotton goods of American and European manufacture is simply the spill-way that carries off any surplus of our production when that surplus rises to a level that permits its sale at prices that can compete successfully with the crude machinery and cheaper labor with which cotton goods have been manufactured from almost prehistoric times in China and in India.

I have been unable to find in the course of considerable research any very definite figures as to the production of cotton in China. Mr. E. J. DONNELL in his "History of Cotton," published as far back as 1872, suggests a probable production in China of 12,000,000 bales. The Agricultural Department of the United States Government in a recently published statement estimates the production of cotton in China and Korea at 1,600,000 bales. Whatever it may be, it is plain, I think, that so far as the export trade in cotton goods of America and Europe is concerned, competition with the home-grown product of India and China is a very much more important factor than is generally recognized, and the figures of the exports of cotton goods from England and America to East India and China for the past four years seem to abundantly sustain this view. They are as follows:

EXPORTS OF YARNS AND CLOTHS FROM GREAT BRITAIN.

(000's Omitted.)

Period.	To	Yarns. Lbs.				Cloths. Yds.				Total Pounds Yarns and Cloths, Cloths Being Reduced to Pounds on Basis 5.35 Yards Equal to One Pound Yarn.				Percentage of decrease in 1904 as Compared with 1902.
		1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.	1901.	1902.	1903.	1904.	
Month of March . .	East India	3,046	2,822	2,800	1,496	188,369	191,377	230,996	196,075	38,255	38,593	45,977	38,145	1.16
	China	328	1,140	561	191	32,022	54,112	45,402	47,536	6,313	11,254	9,047	9,076	19.35
	Japan	434	268	176	43	3,037	5,083	5,083	1,377	1,002	1,218	1,117	300	75.37
	Total	3,808	4,230	3,537	1,730	223,428	250,572	281,431	244,987	45,570	51,075	56,141	47,521	6.96
Three Months Ending March 31st . .	East India	9,334	9,014	8,625	6,639	638,182	574,020	628,161	594,688	128,621	116,307	125,678	117,796	*Inc. 1.25*
	China	1,034	3,431	1,481	605	103,273	196,007	147,682	155,939	20,337	40,068	29,065	29,752	25.75
	Japan	1,987	770	767	121	9,898	16,775	15,540	6,040	3,837	3,905	3,672	1,250	67.96
	Total	12,355	13,215	10,513	7,365	751,353	786,802	791,383	756,667	152,795	160,280	158,435	148,798	7.16
Six Months Ending March 31st	East India	17,917	18,203	17,239	13,389	1,159,897	1,138,900	1,151,731	1,064,429	234,720	231,082	232,516	212,348	8.17
	China	1,273	4,621	2,325	1,352	154,421	337,675	236,835	254,717	30,137	67,738	46,593	48,962	27.73
	Japan	3,947	2,681	982	337	23,530	39,487	33,366	10,761	8,346	10,062	7,219	2,348	76.66
	Total	23,135	25,505	20,546	15,078	1,337,848	1,516,062	1,421,932	1,329,907	273,203	308,882	286,328	263,658	14.61
Twelve Months Ending March 31st . .	East India	33,189	37,590	31,800	25,703	2,129,382	2,037,849	2,177,286	2,093,987	431,204	468,964	438,769	417,108	11.05
	China	1,980	9,336	4,448	3,784	368,512	583,805	526,451	485,948	70,811	118,459	102,850	94,615	20.13
	Japan	9,276	6,268	2,362	760	96,043	70,198	107,881	57,825	27,228	19,389	22,527	11,568	40.28
	Total	44,395	53,194	38,610	30,253	2,593,937	2,961,852	2,811,618	2,637,760	529,243	606,812	564,146	523,291	13.77

EXPORTS OF COTTON GOODS FROM THE UNITED STATES.

For the Month of February.

(000's Omitted.)

	1901.		1902.		1903.		1904.		Percentage of decrease in quantity, 1904, as compared with 1902.
	Yards.	Valve.	Yards.	Value.	Yards.	Value.	Yards.	Value.	
China	4,552	$256	33,738	$1,599	34,643	$1,714	13,832	$787	59.00%
Japan	1	....	6	1	30	2	4	0	33.33%
British East India	506	32	1,996	114	1,007	57	684	47	65.73%
Other Asia and Oceania	3,096	145	1,647	71	2,780	125	1,933	119	*17.36%* increase
	8,155	$433	37,387	$1,785	38,460	$1,898	16,453	$953	55.99%

For Three Months Ending February.

(000's Omitted.)

	1901.		1902.		1903.		1904.		Percentage of decrease in quantity 1904, as compared with 1902.
	Yards.	Value.	Yards.	Value.	Yards.	Value.	Yards.	Value.	
China	8,054	$451	92,321	$4,370	73,666	$3,713	26,428	$1,499	71.37%
Japan	26	5	32	5	154	13	24	3	25.00%
British East Indies	646	42	4,887	274	3,210	190	2,626	170	46.26%
Other Asia and Oceania	4,278	201	4,750	210	11,149	498	8,653	484	*82.17%* increase
	13,004	$699	101,990	$4,859	88,179	$4,414	37,731	$2,156	63.00%

EXPORTS OF COTTON GOODS FROM THE UNITED STATES. — *Continued.*

For Six Months Ending February.

(000's Omitted.)

	1901.		1902.		1903.		1904.		Percentage of decrease in quantity, 1904, as compared with 1902.
	Yards.	Value.	Yards.	Value.	Yards.	Value.	Yards.	Value.	
China	8,808	$504	151,666	$7,317	124,650	$6,287	40,253	$2,157	73.46%
Japan	140	19	516	38	180	15	97	11	81.2%
British East Indies	5,351	285	7,846	440	5,620	330	4,894	314	37.62%
Other Asia and Oceania	8,268	394	11,666	521	20,754	933	17,004	916	*45.76%* increase
	22,567	$1,202	171,694	$8,316	151,204	$7,565	62,248	$3,398	63.74%

For Twelve Months Ending February.

(000's Omitted.)

	1901.		1902.		1903.		1904.		Percentage of decrease in quantity, 1904, as compared with 1902.
	Yards.	Value.	Yards.	Value.	Yards.	Value.	Yards.	Value.	
China	74,702	$4,021	265,328	$13,191	308,262	$15,335	152,099	$7,494	42.68%
Japan	312	40	666	53	472	29	187	20	71.92%
British East Indies	9,370	534	10,731	618	11,554	664	8,396	526	21.76%
Other Asia and Oceania	19,671	995	31,944	1,443	32,269	1,476	36,014	1,820	*12.74%* increase
	104,050	$5,590	308,669	$15,305	352,557	$17,504	196,696	$9,860	36.28%

The decrease in the exports of manufactured cotton goods as compared with the corresponding period in 1902, which was the last year of normal prices, is as follows:

	For March, 1904.	For Quarter Ending March 31, 1904.	For Six Months Ending March 31, 1904.	For Year Ending March 31, 1904.
From Great Britain to China . .	19.35%	25.75%	27.73%	20.13%
From Great Britain to Japan . .	75.37%	67.96%	76.66%	40.38%

	For February, 1904.	For Quarter Ending Feb. 29, 1904.	For Six Months Ending Feb. 29, 1904.	For Year Ending Feb. 29, 1904.
From U. S. to China	59%	71.37%	73.46%	42.68%
From U. S. to Japan	33%	25%	81.2%	71.92%
From U. S. to Entire Orient . .	55.99%	63%	63.74%	36.28%

The figures show, it will be noticed, a very direct relationship between the price of cotton and the volume of manufactured goods exported, and disclose, in my opinion, a compensatory relationship between the Oriental and Occidental production of cotton, to which little thought has been given, but the subtle influence of which acts, nevertheless, as a safety valve of no small value in controlling the explosive disposition of cotton speculation in America when it reaches a dangerously high pressure.

It would be presumptuous on my part to come here with any suggestions as to the policy which the American spinner should pursue in the present contingency, or in the not distant future of the new crop. You understand your business far better than I do. I have aimed only to point out to you one or two aspects of the situation that seemed to me especially significant at present, and if I am allowed a moment more of your time, I would say that there are some things in connection with cotton, that while almost axiomatic, are not always recog-

nized. One is that it is as certain as any economic proposition can be that in a country as progressive and intelligent as America, an article that costs 6 cents a pound to produce and can be sold from 10 to 11 cents will shortly be produced in a sufficient quantity to meet all possible demands. The genius that has developed our American railroad systems; that has invented the telephone and the trolley car, and developed them *parri passu*, with the demand, will not long be neglectful of the opportunity for profit that exists in cotton planting where cotton can be sold at 10 cents a pound or over, and despite the predictions of famine I have confidence that America will not long go unclothed and that in clothing us the textile manufacturers of America will not long be despoiled of their legitimate profit, especially when the remedy is entirely within their own hands, for whatever exaction uncommercial speculators may attempt to make of them during the few months yet to be endured of the present season before a new and probably an exceptionally abundant crop shall be available. A letter received by me from a very careful student of English conditions, dated Liverpool, April 9th, suggests the feeling now apparently growing on both sides the Atlantic. It says:

"There is such a thing as being able to do without that which one cannot have, and apparently users of cotton are now considering it. At present, holders have the whip hand unquestionably, and the Lancashire spinner is feeling the lash equally with his cousin in America. Will they join hands and agree on a further curtailment of working hours, or even shut down wholly for a time? The case is in their hands; it would be a simple one but for the discordant elements amongst themselves. They, at least, know the bull syndicates cannot eat cotton. If they do not adopt a drastic policy soon they will have prices rise higher than those ruling last February, and the fault of it be one of their own making. Cannot some bright intellect amongst our Lancashire users rise to the occasion that now offers, and devise not only a rigid working arrangement amongst themselves, but also with their fellow-users in America; or shall America lead the way to a cure for the more than precarious position they both find themselves in?"

I cannot close this address without a very brief allusion to a fact with which I am more and more impressed as I study from year to year the history of the cotton trade and its development, and that is the utter impotence of the individual when arrayed against the operation of natural law, whether this natural law be enforced through the concurrent, though automatic, action of the community of individuals which compose the trade as a whole, or the more subtle, though seemingly regular, alternation of nature's seasons of abundance or of blight. As in the development of our character morally, the capacity to think not of ourselves, but of others, is an essential, so in the commercial and economic worlds it seems to me that the first essential of a clairvoyant and economic vision is the ability to subordinate the ego and to avoid the assumption that things must be because our own preconception or possibly our interests, suggest that they may be. Moral myopia and commercial nearsightedness are both often the derivatives of the same disorder, namely, an exaggerated self-appreciation; and the capacity to see things as others see them, and to correlate events not so much in the light of our own experience as in their real relation to the entire body of which we are an inconspicuous part, is necessary, in my opinion, to any correct reading of conditions, whether these conditions have to do with the most important or the least important affairs of life.

If I have failed to take my own advice and in this address have erred in striking the personal note too strongly and too loudly, I beg that you will forgive me. The opportunity to address you is one that I appreciate most highly, and I shall be sorry if I have seemed to be didactic when I have really meant to be interrogatory and to learn rather than to teach.

THE PRESIDENT. Gentlemen, you have heard Mr. PRICE'S address. He is ready to answer any and all questions with reference to what he has said. Will some member be good enough to open the discussion?

Mr. JAMES R. MACCOLL. Mr. President, I would like to ask what effect Mr. PRICE thinks the boll weevil will have upon the future crop?

Mr. THEODORE H. PRICE. I think, sir, that American ingenuity ought to be able to devise a means to deal successfully with the boll weevil. Only day before yesterday I received a letter and a telegram from different parts of Texas, in both of which it was stated that it had been found that a certain solution of Paris green dealt with the boll weevil very successfully and the newspapers already have commenced to proclaim that fact in Texas. I recollect when I was a small boy that the army worm was the great cotton pest and its coming meant a fluctuation of several points in the New York market, and Paris green was found efficient to be used there. I am not as apprehensive as are many imaginative people in regard to the depredations of the boll weevil. We have found poisons for microbe organisms of very much more subtle character than the boll weevil, and it seems to me it is to express a very low opinion of American ingenuity to assume that we cannot get something to deal with the boll weevil. But at all events the total damage to the Texas crop at the outside is only 200,000 bales. I think the statistics will support me in that statement.

The PRESIDENT. We will call upon Mr. RUSSELL W. EATON of Brunswick, Maine, for his paper on "Preparation for Mill Management." Mr. EATON, gentlemen, as you are aware, is one of the ex-presidents of this Association, and there is no doubt that we shall listen to him with attention and interest.

PREPARATION FOR MILL MANAGEMENT.

RUSSELL W. EATON, Brunswick, Maine.

The proper course of training for a young man who intends to become a lawyer, physician, minister, journalist or civil or mechanical engineer is fairly well defined and acknowledged. No well defined course of training for one who intends to be a manager of a mill has yet received general approval. This is not because the profession is uncertain in its requirements or lacking in its financial rewards or light in its duties. On the contrary, the requirements are fairly well known, the emoluments compare favorably with most professions and the duties are arduous. With the rapid growth of industrial enterprises in recent years, the requirements, emoluments and duties have also grown and it may be due to the short time that these great industries have existed that no settled and permanent course of training for them has been outlined and generally accepted. Whatever may be the cause, has not the time now come for a more careful examination of the qualifications needed by one occupying such a position, and the determination of the best means for acquiring them?

Let us then endeavor to outline some of the more important qualifications. A mill manager is placed in charge of very valuable property which must be safe guarded, kept in the highest possible state of efficiency, improved as experience may direct and employed to the fullest extent, and he is to direct and control the work of many people so that the output of the plant shall be the maximum in quantity and quality. He is the holder of a valuable financial trust and the captain of an industrial army. For the performance of his duties he needs first to real-

ize his obligations to the owners of the property and to the workmen who have placed themselves under his direction and control. No man can be a successful manager who uses the interests intrusted to him as a means primarily to his own enrichment or the power he holds over his employees as opportunity for oppressive treatment that he may gain prominence. With this, he must have the strong, positive determination to succeed and I place as the prime requisites, undivided loyalty to his trust and a fixed determination to succeed. These two qualifications are fundamental.

A mill manager should be thoroughly acquainted with the processes required in the operation of the plant. He should be prompt to see where improvements can be made and, as far as lies in his power, make them. He should be able to select suitable men for the oversight of each department, treat them fairly without fear or favor, and observe that they in their turn do the same by those under them.

He should not be easily discouraged by accidents or misfortunes. He should be quick to decide those questions demanding immediate answer and careful in action when large interests are involved.

All these requirements come readily to our minds. The list might be considerably enlarged, but let us take them as illustrative of all. Loyalty and honesty, determination to succeed, self-reliance, familiarity with the work, ability to discern improvements, selection and government of men, courage, decision, caution. With these requirements in mind what training will best develop them in a young man?

It is my belief that *loyalty* and *honesty* must be born in the man, that no subsequent training will ever put them there. *The determination to succeed* comes from struggle, and nothing else will develop it. The pampered child knows not the pleasure of striving and winning. This requisite is so pre-eminent that we sometimes feel that no great leader can be reared in ease, that no mill manager can be successful in his business who has not already had struggles to overcome. A college course often

developes this desire to succeed by the competition of the class room, and the athletic field. One gets a taste of the joy of winning which will lead to further endeavor. We must not, however, minimize the great good to a man that may come from struggling against and conquering adverse financial conditions in youth.

The important factor of *self-reliance* comes properly from knowing and knowing that one knows.

This leads to our next item, *familiarity with the processes* of manufacture. A mill manager must know the business in its details if he is not to be dependent on others. This is too self-evident to need amplification. But he ought to know not only these details but the general laws on which they are founded. To know how other men in the past have been doing things, and how these are now being done, is not enough. He should understand why. He should know the reasons, the general broad principles of physics or mechanics on which the best methods ultimately rest.

From this broad knowledge, only, will come the *ability to discern improvements*. I believe it is safe to assert that the most valuable improvements have been suggested or devised, not by those most closely connected with the operations but by those whose general or broad knowledge has enabled them to apply new principles of construction or action. Here I would plead for a young man's training which shall be broad and not specialized.

The same general principle applies to the *selection and government of men*. Nowhere will breadth of knowledge be more useful. The present chaotic condition of the labor world with the undefined relations of capital and labor ought not to exist. I believe they would not so exist if in the past all directors of labor had been properly trained as to the respective rights of each. A captain of industry needs a trained mind in order to lay out a safe line of action. He must learn by associating with the workmen what are their points of view and he should also have the benefit of the wise teaching he can obtain in the schools.

Let us now consider the elements of *courage, decision* and *caution*. While we must admit that these qualities are inherent rather than acquired still they can be strengthened by proper training. This strength will come by their exercise and the opportunities should be commensurate with the young man's abilities. They will first show in small things and grow with the growth of the boy. As a young man let him have fellows of his size for competitors and young men's problems for his decisions. So let his character be developed to enable him later to meet unflinchingly the sterner problems of life. To start with a boy just breaking into young manhood, to see his mind gradually unfold as he realizes little by little the large world in which he lives, with its great men to emulate and their deeds to study and admire, to see his thoughts broadening in the schools, to see him assimilate this knowledge and steadily developing his individuality, apply all his acquired strength to his life work and advance to honorable position, is to see the finest of all sights.

I am not prepared to admit that the life of the business man presents less opportunity for achievement than that of other professions. The management of a great enterprise like a cotton mill requires the continuous exercise of qualities which in other professions leans to honorable mention. Therefore I heartily believe in the broadening and strengthening influence that can come from college training, and especially in a small college, where the immediate connection with his trained instructors and the contact of the young man with his equals, out of the class room as well as in, gives a training that cannot otherwise be acquired. But, essential as I believe all the results of college training to be, I know that the young man who intends to be a mill manager must become thoroughly acquainted with the machinery, the processes and the workmen. The life and spirit of the work must become as natural to him as the air he breathes. To govern men he must come to know them, he must be a part of the system along with them, sympathizing with their feelings and looking at problems with their eyes and from their point of view. Is it possible to do this after a young

man has come to the age of 23 or 24? And, if not, then at what point should the young man be taken from school and placed at work and what work should he be set to do? If we cannot give him all the schooling that we would wish, without robbing him of the desired practical experiencc and if we cannot put him at work at the right time without withdrawing him too early from school, how shall we choose?

It was with such questions as these seeking answers that I took the liberty of sending circulars to about 200 of our members with this query, "If you had the direction of the education of a bright boy, fourteen years of age, just through the Grammar school, who wanted to become a competent mill manager at thirty years of age, what course of study and work would you lay out for him? I am desirous of knowing how long you would send him to school and particularly if you would send him through college." The accompanying sheet provided blanks to be filled indicating the point at which the boy should be taken from school or college, or Institute of Technology, also the number of years, if any, that he was advised to spend at a Textile school, a mill office, machine shop, machine builder's work, mill engineer's office, cotton broker's office, and the various departments of the mill.

The replies began to come very early. They were from treasurers, agents and superintendents, from small mills and large ones, from north and south, also from a few machine builders and a few educators. I think the list is representative of our membership.

I received replies from 119 members and I take this occasion to thank these gentlemen for their kind attention to my circular letter.

Many replied that the subject was "too hard," "too deep," "a great puzzle" etc., or that they did not feel qualified to give the advice desired, and 7 therefore asked to be excused from replying.

Of the 112 remaining, I have endeavored to carefully collate the replies and I present them without further comment.

I find that six advise the boy to leave school at the end of the grammar school course.

Of these, three would have him then enter a Textile School for three years or more, while three members, whose success in manufacturing certainly entitles their ideas to much consideration, would then put the boy at work and keep him at it without further schooling. Six members advise the boy to leave school before the end of the high school course, two advising it after two years and four after three years. All but one of these recommend a two or three years course in a Textile school.

Of the 100 remaining who advise a full high school course 5 would then place the boy at work; 17 would send him to a Textile school; 29 would send him to college; 49 would send him to an Institute of Technology.

Of the 29 who advise a college course, I find that eight would then send the young man to an Institute of Technology for at least two years.

Fourteen would advise his attending a Textile school, the time recommended varying from one to three years, and we have two respondents who advise one or two years in an Institute of Technology and two years in a Textile school after leaving college.

Of the 49 who advise entrance in an Institute of Technology immediately following the high school, I find 29 prescribing a short course varying from one to three years and followed in twelve cases by a one to three years course in a Textile school.

The remaining 20 recommend a full four years course in an Institute of Technology and eight follow this by one to two years in a Textile school. It is interesting to note that 59 members recommend attendance for more or less time at some Textile school.

Summarizing the replies, I find that in three cases the boy is advised to leave all school at 14 years of age, one at 15 years, two at 16, two at 17, seven at 18, one at 19, nineteen at 20 years, ten at 21, thirty-one at 22, fourteen at 23, eleven at 24, five at 25 and five at 26 years of age. These figures are based on the time ordinarily required to obtain the schooling recom-

mended. In fact the age of finishing school would be higher because eleven advise the boy to work at least one year in the mill or machine shop between the high school and later study. Several advise that vacations be employed in this way and five recommend Textile school study nights or by correspondence while employed in the mill.

Of the further division of the young man's time, I find that

54 advise office work ranging from six months to three years.
56 advise from 3 months to 4 years in machine shop.
28 " " 1 year to 4 years in machine builders' works.
42 " " 6 months to 3 years in mill engineer's office.
25 " " 3 months to 1 year in cotton broker's office.

As to the various departments, I find that 45 recommend the most time to be spent in the carding department and 19 in the weaving, while others do not lay especial stress on any department.

In addition to the topics mentioned in the circular I find many valuable suggestions. Two gentlemen urge a year of travel to manufacturing centers at home and abroad, several emphasize the advantage of experience in a good business office and a year in the inspection department of the Factory Mutual Insurance Companies is brought to our attention.

As there is great difference of opinion as to the advantage of a college training I take the liberty of quoting from the replies on this point.

From those opposed, I quote "Higher education or culture will not meet its affinity or find the atmosphere inspiring in the average mill village."

"My reason for omitting the college course is that I think it is better for a young man not to go through college if he is going to run the average cotton mill on account of the class of help that is coming into the mills at the present time."

"I think that a young man who anticipates being an agent of a cotton mill would be wasting his time by spending four years in college."

"A high school or college education tends to make the majority of men feel above the practical part of the business."

"A college course would be superfluous."

"I think that a college course would be of advantage to a man on the social side rather than in performing the technical duties of mill management."

"Would leave out the college course. Boys always do the best who start work early in life. The habit becomes formed and is not so irksome but rather a pleasure."

"Some boys would receive great benefit by taking the entire college course while others are positively harmed by so doing."

"The college course might help the individual as a man but not as a mill manager."

"College gives a man a polish which he can obtain in no other way. It also broadens him. But in my opinion college education is not essential and the four years required for it can be more profitably spent in the mill."

"A college course following the high school course would be very desirable, if after such a course the young man would be willing to begin at the bottom and work up. I think this process is rather too slow for most college graduates. Everything else being equal the one who has been through college has the advantage of the other fellow."

"If a boy is studious and conscientious and uses his time to the best advantage it is a benefit to go to college. If he goes there and spends his father's money and works only just enough to pass his examinations his college course is a curse to him. He forms habits of extravagance and laziness."

"There is no way to train a boy in the humanities of life except by putting him in contact with the humanities. Every college has an artificial atmosphere. This is a very wholesome and excellent atmosphere for a youth but it is wholly different from the big, aggressive and uncompromising business world."

"Many of our best mill managers of today never went further than the grammar school. Different cases need different treatment. A college education does not make a fool of a man, it

only develops the fool that is in him. Neither does college education make a man. It simply develops his manhood." "The mill is the college I should send such a boy to, and if physically fit I should send him at sixteen years of age."

From those in favor of college training I quote: "If the boy has means and time he certainly should finish his college or institute course." "I would have him the graduate of a college without regard to future occupation." "He would at least have an education. Personally I should place a college education above everything." "Granted that the boy is bright and with a turn towards mechanics, with energy and strong physical health, I should by all means advise his completing a college course." "I favor no specializing during the college course, but rather a broad election of academic studies." "My main point is the importance of the college training and that of the Textile school, both of which should be as broad as possible." "I would give him a liberal classical course, as I believe it broadens the youth and better fits him for an all round man than any other education which he could take." "He would at least have an education which would enable him to succeed in some walk of life. I would place a college education above everything."

"As a young man cannot have too much genuine education, I would recommend a college course if he could afford the inevitable delay before settling down to work; and if his college career comprised actual work and not the gratification of social ambitions and amusements."

One who recommends a full college course to be followed by a post graduate course in a first rate technical school says: "Under existing conditions in this country the time required for this is two years too long and costs too much. * * * At twenty-five he will be behind the so-called 'practical man,' at thirty-five he will be way ahead of him with a better knowledge and a quicker aptitude."

(I wish, gentlemen, there was any possibility by which the study of this question by this or other associations would lead

the educators to the settling of that point, namely: how we can bring our boys to the point we want in less time. I think this gentleman has touched a very important matter.)

A noted textile educator who recommends a four-years' course at the Massachusetts Institute of Technology writes: "It might seem as if the four years spent at the Institute might be considered a waste of time, but my experience is that not only is this valuable on account of the general knowledge obtained, but that it induces in a young man systematic methods of approaching any problem, gives a breadth of thought and a mental training and accurate judgment both of men and affairs which cannot so well be obtained in any other way and reduces the time necessary to be spent later to grasp the needed knowledge."

I, also, take the liberty of adding the following remarks from the many received which bear upon the general topic. "One of the most, if not the most, important considerations a good mill manager should possess is the ability to deal with people, and if the young man should work in the mill he would have a chance to develop this quality. I am a thorough believer in the fact that the knowledge required in actual working conditions is of great importance, but I do not believe it is necessary for a man to be a successful operative in any department to be a successful manager."

"Let him hustle until the time comes, as it surely will, when a position opens for a young man, with technical education and practical training, and what is more, one who has proved his ability to stick, stick, stick."

"So much depends on the boy himself, his ambitions, natural talents, etc., that I think it would be necessary to watch his progress and develop his training accordingly."

(This same idea is expressed by a large number of writers.)

"The first great requisite is a natural ability to manage help. I would impress upon him that the way to rise is not by continually thinking of a better job to come but rather to do every job he comes to better than any other man can do it."

A friend of mine who is learning the mill business tells me of

a young man who has been out of the textile school some years and is now engaged in pushing a truck of roving around a card room. After having finished the textile course and worked in the mill two years, he even now has to have the overseer watch him to see that he pushes that truck around correctly.

"A competent mill manager should have a good business training and perhaps two years could be profitably spent in securing it. I consider good business training essential."

"Under an efficient leader I think a young man can learn from the office end some of the most important elements which enter into the making of a good mill manager."

"In no case allow him the privilege of working all over any one department; have him learn thoroughly one thing at a time. then take a position and be responsible for the results." "There is one thing which I doubt if a man can acquire; *i. e.*, the ability to judge men, and when he has made a selection of his subordinates, to keep them loyal and get out of them cheerfully their best efforts."

"I should prefer to have a boy start in a small mill rather than in a large corporation."

"I do not consider it necessary for a young man to attain the age of thirty years before he is capable of managing a mill." "The first thing I would want to be certain of would be the fact of his having a mechanical turn of mind."

"I care not how much theoretical knowledge he may possess, without something of inside experience it would be up hill work."

The PRESIDENT. Gentlemen, the subject brought before you by Mr. EATON is certainly one of very great importance and deep interest, engaging the anxious thought, no doubt, of very many young men and their parents and is worthy the earnest attention and consideration of this Association.

Mr. ARTHUR H. GULLIVER. Mr. President, there is no branch of cotton manufacturing which requires ability any more than the management end, and all of us who have charge of a mill understand how great the trouble is to get a competent man in any position whatsoever in the past. It seems to me that after this very able paper by Mr. EATON that there are several branches that ought to be taken up perhaps in more detail than he has been able to give them in the time allotted for his address. One of these is the question of developing in the boy the ability to handle men. I am a firm believer myself in giving a young man, by that I mean one under twenty-one, a chance to show what there is in him of capability to handle men either in a small or a large body. It seems to me that the mills demand today ability in a manager which never has been asked for before, and that the call is for more competent men every year.

I am one of those who in reply to Mr. EATON'S question made this suggestion — I don't think my words have been quoted in the article that has been read this afternoon, but I believe most thoroughly in the fact that the training of the boy depends upon his bent; that he should be started in the line of understanding what is to be done in a mill or any other establishment before he finishes his training, either in the textile school, technical school or college. I believe that the boy ought to be put into some work where he will be required to do labor that has a pecuniary reward, I don't care whether the boy is thirteen or fourteen or sixteen, but he should be put upon his own feet and compelled to work for other people — not his own family, not his own relations, but to be given work which will receive a certain amount of wages.

I think this is the most important thing there is in reference to the boy's training. I don't care so much what his future course may be, what it may be best for him to do, as to have him to understand before he completes his education that men in general — men, perhaps, in the same walk of life — demand a certain amount of promptness, a certain amount of ability, a

certain amount of willingness to do whatever is brought before him, and it seems to me, gentlemen, that this is the most important thing that can be done in a boy's training. I don't think it makes very much difference whether he should sell newspapers or whether he should be clerk in a store or whether he should work in a cotton mill, but it is absolutely necessary before the boy completes his training that he should understand that men in general demand of him certain qualities which he has got to learn before he will be able to control himself or others.

The question of what final education would be of most benefit to one who intends to pursue the business of cotton manufacturing, is one that it seems to me ought not to be dropped without further explanation.

The question of whether the young man needs the training of a technical school, or a textile school, or a college, is one that to most who have had the advantage of the latter, seems to be answered only one way.

There is no question that the college does not fit one by any special experience, for taking hold practically of a cotton mill, but unless a young man is peculiarly backward in preparation, so that he will be over twenty-two when he graduates, it is very much to his advantage to have had the broadening effect, both of study and acquaintance that a college affords.

It is very true that this does not mean so many years saved in his future work, but if he succeeds, this training will be of inestimable benefit to him in his dealings, not only with his own operatives, but with every man with whom he may do business.

It would be useless to undervalue the training of the technical schools. But for executive management in a mill, it has in a good many cases been considered so many years of actual mill experience saved, which I am sure is not right and will not be borne out by facts. It is a valuable course and one that all of us would have been glad to have taken, but when the mill manager is thrown in direct contact with the various different branches of work, it is very hard to select anything from a technical school, except the general course, that is of

advantage, as it is impossible of a man who fills that position, to successfully specialize the line of work that he is best fitted to do. It would be ideal, of course, to be able to give the time required to combine the college with a year or two of technical education afterwards, but this is practically out of the question. So, that if our young man takes the technical course, let him make it as broad as the school will allow, and feel when he graduates that it is not so many years of experience that will be ones that he can take away from his actual experience in the mill. The same decision should influence his course in the textile school, as after the branch of the industry has been opened to his comprehension by the work of the latter school, it has to be made practical and valuable only by actual mill experience. [Applause.]

The PRESIDENT. A majority of us would agree, sir, with what you have said.

Mr. WILLIAM D. HARTSHORNE. Mr. President, I heartily agree with what the last gentleman has said, but with the qualification which I did not understand him to carry out fully — that before a young man does enter upon such a profession as mill management he ought at least to have an equal advantage with that of any other professional man. We send our boys to college — must send them to college — if they are to become physicians. Theo must not only complete the college course but must complete now at Harvard, at least, and Johns Hopkins, four years' additional course to be properly qualified for the practice of medicine. It seems to me that this is an honorable attitude for the profession to take. I think it ought to be an equally honorable attitude for our Association to take, that a man who is to assume the responsibilities of a mill manager ought to have the training which is really requisite for it.

Now, it may not be true that a college education in itself is of very great importance to a mill manager, but it does afford a means of training his mind and will enable him to acquire the

specific information which is afterwards needed. That is precisely the ground taken in regard to a physician. He must complete his college course; he must have a broad training before he takes up the active technical study of his profession. With the mill manager that technical education can only be acquired in a limited degree in a textile school; the mill itself is the technical school of his education. But unless he has acquired the ability to learn, to classify his knowledge, to understand what it means, to understand the physical properties of matter and the laws of physics in general, while he may, as an active observer and a man who is capable of doing a great many things on his own initiative, become a good mill manager without such an education, yet certainly, as one of the gentlemen has expressed it, while at twenty-five the man who starts in the mill may be far ahead of the man who comes from college, the college man at thirty-five, generally speaking, will be far ahead of the other. Look through any catalogue of the Institute of Technology, Lehigh University, or any other technical school, and observe the names of those who have graduated from these institutions, and how many of them — what a large proportion of them — are men in active business life, managers and men in authority. It seems to me that there can be no question that the attitude of the business world ought to be to take into our midst, men who have the qualities and the qualifications requisite for the highest positions possible to be attained. [Applause.]

Mr. EDWARD ATKINSON. I take the opportunity to say that if you want to see how we prepare some men for mill work and will meet me and Professor NORTON tomorrow morning at any time after nine o'clock in room 4 in the next building, in the basement, we will show you how we convert ordinary mud into fuel — that is, how ordinary boys learn how to do queer things and prepare for practical work in the mill. The little mud-fuel machine will be ready to work tomorrow morning about nine o'clock, and there will be also a very interesting

exhibit of the methods by which we are testing all the fuel and how we prepare boys here. Several of the boys will be there. The bog fuel is developing, now no longer theory, but with the biggest gas men of the country behind it as the future source for the gas engine which is being sold now on a guarantee of one horse power per pound of fuel per hour. It is rather an important evolution from mud, and I would like to have any of you there to see it. I will try to be there at nine o'clock and Professor NORTON will be there at nine o'clock, so you will have an hour.

The PRESIDENT. We are greatly obliged to you and probably some of the members will be only too glad to attend. I suppose that it is entirely unusual for the presidents to discuss any paper; I am not going to inflict any discussion upon you myself, but I cannot refrain from adding a few words upon this interesting question. I myself must plead guilty to the following: "The mill is the college I should send such a boy to, and if physically fit I should send him at sixteen years of age."

I, of course, am a firm believer in education, but I do firmly believe that if a young man's future is to be in the mill, if he is going to have a mill career, the sooner he gets into the mill the better. The mill is the college, in my judgment, where he ought to go as soon as physically able. If these boys are going into any of the learned professions, a college education, in my judgment, is, of course, the proper thing, the correct thing. But I think that probably, I was going to say, nine out of every ten mill managers today never had any benefits of the advantage of college education.

A young man who enters the mill at twenty-one, twenty-two, twenty-three, twenty-four or twenty-five, in my judgment and from my experience goes in from five to ten years handicapped, from the fact that these boys, the sons of the workingmen, are put into the mill as a necessity and have advanced so many years and have learned and gained so much practical mill experience and knowledge before these other young men come into

the mill. Again, I have no doubt many of you gentlemen have had young men, college men, come to you and ask for situations in the mill. We have them frequently. We have no vacancies, we have not time to wait for those people, and where they do get in I can say, as far as my experience goes, that there is not one out of thirty-five who stays in. I have merely given you, gentlemen, to attempt to keep up the discussion, my own views of the matter, the same as these other gentlemen. Will any one else kindly discuss?

Mr. WILLIAM L. LYALL. The President's remarks have drawn to my recollection a paper from which we might establish a parallel, which was delivered at the last meeting of the American Society of Mechanical Engineers by the president, Mr. JAMES M. DODGE, on the money value of a technical training. He applied it to a machine shop and the data from which he drew were obtained from his own shops, those of the Link Belt & Engineering Company of Philadelphia. He went at it in this way: He divided the classes of young men into three,— those that had the ordinary shop training, entering when they were sixteen years of age. Class No. 2 were those who were trade school graduates, entering the shop when they were nineteen, after a three years' course in trade schools. Class No. 3 were the technical school graduates, entering when they were twenty-one or twenty-two. The minimum number of examples he had to gather his statistics from was, I think, twenty-two, and the maximum in one class — that is, presumably, of the shop class — was sixty or seventy, so he had sufficient from which to establish a fair average. His statistics were made up over a period extending from ten to fifteen or twenty years. He found that at the age when the trade school man came into competition the shop man was ahead of him. Of course the technical school man was not in it at all at nineteen; he was in school. But at twenty-one the trade school man was ahead, I think. At twenty-five he was considerably ahead of the shop man, and the shop man had reached a point where his wage had reached

its maximum, practically. From that point to the age of thirty-two the curve rose very slightly, I think only a few cents. I think the average was something like $2.32. The trade school man went on increasing; I think he passed the shop man at the age of twenty-two, three years after he left his trade school, and he went on until at the age of thirty-two he was earning $3.50 or $3.75. The technical educated man did not get much during his first or second year, but at the age of thirty-two his wage averaged yearly something like $2,200, which was considerably more than any of the others per day, and the curve showed possibilities of a very much greater increase in the future; it was very rapidly rising. I think that for the position of mill manager Mr. WALMSLEY'S statement does not agree with this experience, and I am inclined to the other side of the argument.

Mr. J. F. POWERS. Mr. President, I rise to ask who the practical mill manager of today is? Is he the graduate of a textile school, or is he a graduate of practical experience in the cotton manufacturing business? I think by putting that question fairly before the members of the Association, it will not be necessary to go into the practical details as to what scientific knowledge in cotton manufacturing is. I believe that, taking a boy as a graduate of a grammar school, giving him a textile school education, putting him into a cotton manufacturing plant and making him start at the beginning, working his way carefully and slowly through the entire plant, he will practically come out point for point, and possibly in advance of the college graduate with a textile school education, who has had no practical experience inside the mill, with a possible six months through the influence of his father or some financial influence behind him that has pushed him through and put him into a position. The boy who has had a practical education in the mill after the practical experience in the textile school will show that ability which is double if not treble in value to the manufacturer, than the boy who is merely the graduate of a

textile school without practical mill experience. Now, I do not deride or decry a textile school by any manner of means. I think the young man of today who has sufficient financial backing and influence behind him who will take a textile school education and who is willing to go into the mill, start at beginning and put at least three years into the mill to work his way up, will make without the possibilities of a doubt, a practical and successful manufacturer. But the graduate of a textile school as we have them today, as we have them particularly in the South, who has put in six months or a year in a textile school in the New England States and then undertaken the management of a plant, has proven without the possibility of a doubt and will continue to prove a successful failure. [Laugher.]

Mr. EDWARD ATKINSON. Mr. President, I never had any education myself in the ordinary sense, and when I went before the Committee of the House of Representatives to advocate the grant of land to this institution, where the water was then eighteen feet deep, I testified that I had seen enough money wasted in manufacturing and had shared in wasting a considerable part of that money, enough to have built an Institute of Technology in every county in the state, for lack of the kind of training that has since been given in this and other institutions of like nature. And in my experience since then, both while I was still in the cotton spinning business and since I have served as the Spanish fly and porous plaster to keep you in a state of wholesome irritation for twenty-five years about your conditions, that conviction has been more fully sustained, and I doubt if any of you are fully aware of how much has been done by the development of technical education. Even if the men who have been trained in the technical schools or in the textile schools are not now the managers of factories, that has little to do with it, they may be somewhere else. The conditions which I have reached, after having boxed the compass on how to bring up a boy, is that very much depends on the

boy, and that you cannot lay down any cast iron or simple rule how you will bring out what there is in that boy. But when people come to me and ask, as they very often do, "What shall we do with our boys?" I tell them, "If you can afford it, put them through the best schools, put them into the university, and put them through the old curriculum of Latin and Greek, in order that they may develop their own minds by dealing with something with which they will have very little to do in later life, and by finding out what they have inside of their heads, then choose in which direction to develop their future life." And I have reached this conclusion, that the young man who either goes through the mill or the technical school without that broadening and training of the mental capacity will be very often an extremely successful man according to the ordinary measure of success, but that the man who has taken the full curriculum and who has the capacity for doing the practical work will be on top at the age of forty. He may not be in the mill, but he will be where he will be picking out the men to put into the mill. And after all, you all know that the greatest capacity of all in the management of a mill is to know how to pick your men, each of whom in his place knows more than you do but does not know much else, and then combine that force under your power of administration. It depends on what you call success, what kind of a training you will give in the direction of the boy. [Applause.]

Mr. J. F. POWERS. Mr. President, I would like to ask our worthy brother if he would take two boys at the age of twenty, one without a practical mill experience at all, and one who had spent his life from the age of fifteen to twenty in a mill, both boys being supposed to be naturally bright and smart, with a desire to learn; one with the practical study of manufacturing in the mill; the other a graduate of a grammar school with a college education and a textile education afterwards, — giving both boys the same chance until the age of forty, which one of the two men he would consider the smartest, brightest, more apt and able to manage a plant of the two.

Mr. EDWARD ATKINSON. I can answer that question very simply, sir. I should bring the boys before me separately, I should turn them inside out, and I should choose the one whose inside turned out the greatest capacity. [Laughter and applause].

Mr. E. STANLEY GARY. Mr. President, probably it would be a little more becoming for me to listen and not say anything but on this particular subject I am interested in three different ways. In the first place, I started in the mill at sixteen, and no gnardian has been appointed yet. In the next place, I have two boys considerably larger than I am, whom I have got to educate, and I am going to put them through a technical school and I am going to develop the fool that is in them as quick as I can. [Laughter.] I believe that a man is simply made up of what he can learn and acquire and assimilate from others, and he can get that concentrated in a technical school a great deal quicker than he can by rubbing up against people in every day life. I believe if a boy is a fool the quicker you find it out the better and let him alone to drift into his natural position. The more education you give him the better he is going to be fitted for after life, the more valuable he is going to become, not only to himself, but to everybody he is associated with. Therefore, after having had to study the question from my own standpoint, I believe in giving a boy all the education he will take and let him take his place afterwards. I don't believe there is a man here who cannot count among his associates not one but dozens of men about whom he has made the remark, "What a magnificent man he would be if he had only had a proper education." [Applause.]

Mr. EDWARD ATKINSON. In regard to the direction of the boy I am reminded of a story. Governor RICE had a son who used to go out to the old place Sundays to go to church and have a day in the country. Coming home from church one Sunday his father asked him, "What was the sermon about?"

"About the Prodigal Son." "Did you like it?" "No." "What was the matter with it?" "Why, the minister put it all on the boy. It wasn't the boy's fault at all, it was the old man's fault. The old man called the boy up and gave him half his money before he knew how to use it and left him to take care of himself. Of course the boy came to grief. It wasn't the boy's fault, it was the old man's fault." That was the boy's version of the Prodigal Son. That is a version that many have witnessed in every-day life.

The PRESIDENT. Gentlemen, if there is no further discussion I will repeat that it is seriously hoped that this entire matter may receive the very widest circulation.

This session stands adjourned until 2.00 this afternoon.

SECOND SESSION.

WEDNESDAY AFTERNOON, APRIL 28, 1904.

The Association met in Huntington Hall at 2 P. M., President WALMSLEY in the chair.

The PRESIDENT. Gentlemen, will you please come to order.

The next paper is one of the historical accounts of a portion of the cotton manufacture, which has hitherto escaped a public record.

These historical papers add a great deal to the permanent value of the Transactions, and it is hoped that there will be further contributions on similar subjects.

In the absence of the author, the Secretary will read the paper by JAMES CLARK, Esq., of Paisley, Scotland, on The Origin of Sewing Cotton.

THE ORIGIN OF SEWING COTTON.

JAMES CLARK, Chapel House, Paisley, Scotland.

A hundred and fifty years ago (1753) an humble Scotch Renfrewshire farmer named ALLAN CLARK died, leaving a wife and six small children unprovided for. Consequently the poor widow was compelled to move into the manufacturing town of Paisley in order to find employment for herself and her young family to enable them to earn a living.

At that time, the principal manufactures carried on in Paisley were coarse linen and chequered cloths, silk and gauze fabrics and harness shawls, imitations of the Indian shawls of Cashmere, for the making of which latter Paisley long continued to be famous, so that there was a regular demand for good handloom weavers who then could earn excellent wages.

By dint of hard work and careful habits, the young CLARKS prospered, and as weavers, got on well in the world. Two of the brothers of the family, named PATRICK and JAMES, were enterprising, and added to their weaving business the making of silk twine for the manufacture of heddles, an indispensable requisite of every loom, also a department for the supply and sale of weavers' furnishings.

Near the beginning of last century Paisley attained a high state of prosperity. Its trade required much silk for the manufacture of Heddle twine, the supply of which came from Hamburgh, a German Hanse or Free Town.

In 1803 NAPOLEON BONAPARTE conquered northern Germany

and his troops occupied Hamburgh. France was at that time at war with Great Britain, as well as with the majority of the Continental nations, and in order to cripple British industries, NAPOLEON caused the stock of silk found in Hamburgh to be burned, to the great consternation of the Paisley weavers who dreaded the ruin of their industry.

The senior JAMES CLARK (born 1747, died 1829) manufactured silk heddle twine and heddles in Cotton Street, Paisley, as did also his brother, PATRICK, at the foot of Moss Street in the same town.

FIGURE 1. THE COTTAGE ON COTTON STREET, PAISLEY, SCOTLAND.

The supply of silk having been destroyed, these two brothers were driven to their wits' end to discover what was best to do in their trying circumstances, when the happy thought occurred to PATRICK CLARK to substitute cotton warp yarn for silk, and twist it into thread in the manner that six cord sewing thread is made at the present day. Fortunately the experiment succeeded, heddles continued to be efficiently made with cotton twine instead of silk, and supplied to the trade, so that the weaving industry continued to go on uninterruptedly, as before NAPOLEON'S wanton destruction of the silk material.

FIGURE 2. JAMES CLARK, FIRST.

The doubling frames by which heddle twine was twisted at that distant period contained only forty-eight spindles each and were put in operation by manual labor supplied mostly by strong young men from the Scottish Highlands, a man being required to drive each machine.

JAMES CLARK'S son, JAMES junior, (born 1783, died 1865) was then his father's manager, and besides selling weavers' furnishings, he also sold linen thread for domestic sewing purposes, cotton thread being then unknown to the ladies.

To young JAMES CLARK, linen thread appeared to be rough and uneven so he recommended the substitution of the smooth cotton thread to his lady customers instead, and after one trial of the cotton thread it was invariably continued to be used.

Originally the cotton thread was sold in hanks or skeins, and then the ladies had to wind it into little balls as they generally

FIGURE 3. JAMES CLARK, SECOND.

wind a cut of wool yarn at the present day. Wishing to convenience his fair customers JAMES would, on selling a skein of cotton thread, sit down at a weaver's pirn wheel, and wind the thread upon a spool, for which he charged a halfpenny (one cent) but that halfpenny he refunded when the empty spool was returned to him. The spools cost twelve cents a dozen, and were ordered by young JAMES to the extent of half a gross at a time from a wood turner named ROBERT PAUL, which he carried home in his coat pocket to wind thread thereon by his own hand, after the sale of a skein had been effected by him.

This is the simple story of the birth of the spool cotton thread trade, an interesting, if not a wonderful, example of what great results may be produced from apparently insignificant beginnings.

FIGURE 4. JAMES CLARK, THIRD, THE AUTHOR OF THIS PAPER.

In the course of years many thread manufacturing companies were established in Great Britain. The industry naturally predominated in Paisley where seven thread companies were established, of which only one exists as the combination of several different interests.

The CLARK interests with those of others have been merged into the present J. & P. COATS Limited which are enclosed in

60 acres of ground, requiring an engine horse power of 20,000, consuming 250 tons of coal per day and giving employment to over 12,000 operatives. This company owns mills at Newark and Pawtucket in the United States and also works in Russia, Spain, Germany and Austria as well as large establishments in England, which combined can't employ fewer than 30,000 operatives at the present moment.

FIGURE 5. DUNN SQUARE AND CLARK HALL, PAISLEY, SCOTLAND.
(X indicates the site of turning shop in which the first spools were made.)

FIGURE 6. CLARK'S THREAD MILLS, PAISLEY, SCOTLAND.
(Showing two-thirds of their buildings in Paisley.)

FIGURE 7. COATS' THREAD MILL, PAISLEY, SCOTLAND.
(Showing one-fourth of their buildings in Paisley.)

The PRESIDENT. The next paper in order, gentlemen, is "The Spindle Situation," by General WILLIAM S. DRAPER of Hopedale, Mass. General DRAPER needs no introduction here, and I will say that when men of such notable prominence as the General show their interest in our work by their presence, we may indeed congratulate ourselves. [Applause].

General WILLIAM F. DRAPER. Mr. President, gentlemen: First, I must thank the president for his very pleasant introduction, and I wish to say to you all before I commence to read that I have found your acquaintance not only pleasant but profitable. [Laughter.]

*THE SPINDLE SITUATION.

GEN. WILLIAM F. DRAPER, Hopedale, Mass.

Mr. President and Gentlemen: When invited to present a paper at this meeting on the subject of Spindles, I was inclined to demur, on the ground that this subject had been fully discussed by myself and others at your meetings before. Mr. JACOB H. SAWYER, the inventor of the Sawyer Spindle, my respected father, GEORGE DRAPER, and others interested in the introduction of the Sawyer and Rabbeth types, have recounted their advantages, and explained their construction and operation, in great detail. Various gentlemen interested in competing structures (now largely or entirely obsolete), have presented the subject from their respective points of view; and I personally have prepared and read at least two comparatively elaborate papers, one on "The History of Spindles," and another on "The Development of Rapidly Running or Yielding Bearing Spindles."

Besides this, every one of you has had a continuous object lesson in your mills, where spindles of the types introduced by the company which I represent, or its predecessors in business, are universally running; and the older men among you have had full opportunity to compare these rapidly running spindles with the old structures.

It is useless to enter again into details of construction; you all know them. It is also useless to explain or detail the advantages derived from their use. You all know them also, and have shown your faith by your works, in filling your mills with

* For further references on the subject see Transactions as follows: J. HERBERT SAWYER, Vol. 10, p. 47; GEORGE DRAPER, Vol. 11, p. 14; Vol. 14, p. 25; Vol. 26, p. 48; CHANNING WHITTAKER, Vol. 38, p. 49; WILLIAM F. DRAPER, Vol. 44, p. 15; W. N. GODDARD, Vol. 44, p. 18; WILLIAM F. DRAPER, Vol. 50, p. 13; Vol. 57, p. 118; GEORGE OTIS DRAPER, Vol. 63, p. 173; Vol. 73, p. 161.

the new spindles. No new mill in this country uses anything else, so far as ring spinning is concerned; and the same is true of Great Britain, and France, and Germany, and the machine using world generally. The spindle and distaff may still produce yarn in some barbarous nations, but the RABBETH Spindle, producing a thousand to one, will in time eliminate them, as it has already done in the civilized world.

This paper must therefore be of a general character, recording a revolutionary advance in human methods, rather than an argument for an experimental or partially introduced device.

I might go into the progress of introduction between 1871, when the SAWYER Spindle was brought out, and the present time; but this also has been thoroughly exploited, and I will only mention a few salient dates. In 1875, or thereabouts, there was extended litigation, lasting some years, to decide whether the RABBETH rigid bearing spindle of that time came within the SAWYER principle, the court deciding substantially that it did, though the issue was on a subsidiary patent taken out by my father, GEORGE DRAPER. About 1880 came the introduction of the New RABBETH Spindle, with cushioned bearings, which made a place for itself in the market at once, on account of its capacity for high speed, though its early faults prevented it from superseding the SAWYER for several years. Later came the introduction of the SHERMAN and WHITIN types, each contributing marked improvement to the general art. Later still, about 1895, the DRAPER type was evolved, being based largely on inventions of my brother, GEORGE A., and myself; and that, the WHITIN, and the MCMULLAN, are the types almost universally sold today.

All through this time there has been litigation, which has established the validity of our patents, and settled the fact that the inventors above named were the *original* inventors of the devices which they patented; and that hence they are entitled to be enrolled among the most notable inventors of this inventive age. RABBETH, and SAWYER, and SHERMAN, and TAFT (the principal inventor of the WHITIN Spindle), have contributed

as much to the spinning art as did ARKWRIGHT, HARGREAVES and CROMPTON; in that their conceptions enabled the production of the machines invented by these former great inventors, to be doubled, and the cost of the product to be lessened in greater proportion.

Since what I am saying is largely historical, I will not omit mention of the DRAPER family in this connection. They have furnished much of the inventive talent that has perfected and combined the ideas of the inventors named, and scores of others; they have perfected the processes of manufacture of the various parts, to a point far beyond anything before attained; they have conducted the litigations; harmonized differences of interest; made long and costly scientific experiments, to ascertain underlying principles; and introduced the perfected structures to the manufacturers of the world. But for the mechanical judgment, self reliance, and unlimited energy of GEORGE DRAPER, some of the most important of these spindle inventions would have become abandoned experiments; and his successors have greatly perfected the structure, and carried the work of introduction commenced by him, to a satisfactory conclusion.

It is but seldom that any improvement of a radical character comes into general use during the life of the original patent, as did the RABBETH form of spindle, as perfected by the Draper Company. The reasons for the great success in this case are: first, the enormous value of the improvements (which I have endeavored to state, approximately, in previous papers); second, the low royalty collected, in comparison with the gains from their use; third, the actual saving of money in equipping a mill with these spindles, as compared with an equipment of the old kind, for the production of a given amount of yarn. The present spindle produces substantially twice as much yarn, on the average, as the spindles in use in 1870, while the cost of the present machines, royalty included, would be only ten to fifteen per cent. greater with the rapidly running spindles than with the old slow running ones. This means, and has meant, a heavy saving of first cost in equipping a new mill; as well as a larger

proportional saving in the cost of running afterwards. The fourth reason was the generally intelligent and appreciative attitude of the cotton manufacturers of this country toward new improvements, when their value has been demonstrated. Some, of course, were timid and slow (there have always been such men), but the larger number welcomed, and let us hope are still ready to welcome, a real improvement of a substantial character.

As before stated, the saving in first cost made introduction comparatively easy in new mills; and the competition of the new mills made a change in the spinning machinery of the old ones necessary.

After a lifetime largely spent in the introduction of improved processes, I have come to the conclusion that there are three stages in the adoption of any real improvement that has enough energy and financial backing behind it to insure it a fair trial:

First. The stage of experiment and perfection, — the overcoming of mechanical difficulties, and the troubles incident to the use of any new device;

Second. The stage of adoption by the enterprising, who cheapen or improve their production, while their competitors keep along in the old ruts, or try to find a "cheap and nasty" substitute; — and

Third. The stage of general adoption, when the most conservative are driven either to adopt the new thing, or to maintain a higher cost or a poorer product than their more far-seeing competitors.

Anyone who has done business as long as I have with *you*, Gentlemen, can judge without asking, who will be the first to try an alleged new improvement, and to adopt it if its claims are substantiated. He will know who will seek another way to approximate the desired result, and who will wait till a large introduction shows the device so perfected that there is no risk in buying it, and that there is a *certain* loss in waiting longer. He would also know, as I have learned from the introduction of the spindles under consideration, that adoption is only a question of

time with you all, if the new machine possesses merit, and is sold at less than its value *to you*.

This retrospect, it is needless to say, is to me a very pleasant one. I have no desire to take, either to myself or the Company which I represent here, undue credit; but there is a satisfaction in accomplishment, and in looking back from the standpoint of success upon difficulties overcome. If the DRAPER family accomplishes nothing more of a revolutionary character, (and we have still other similar work in hand), we, and inventors connected with us, have advanced the processes of a great industry, and one of the most ancient ones, — the spinning of cotton, — substantially as much as all others between the time of the first twisting together of fibres by hand, and the middle of the last century. There has been a pecuniary gain connected with this, it is true; but that is as nothing compared with the fact that cotton cloth, one of the necessities of life, has been made cheaper for the human race for all time. In this connection I venture to repeat a quotation from Lord BACON, which I made use of in an address before the Southern Cotton Spinners Association:

"The benefits of new inventions extend to all mankind universally, but the good of political achievements respect but some particular cantons of men. These latter do not endure above a few ages; the former forever."

I come now to a consideration of the spindle business as it exists in this country at present. There is a temporary lull in the demand, owing to the disturbances in the cotton market; but more spindles will be wanted, as surely as more cotton cloth will be wanted. New mills will be equipped, and old machinery will be replaced.

On the forms of spindle which we have sold of late years, valuable patents are still in force. On the DRAPER spindle we control the screw step arrangement, — the DAY spring, the WOODMANCY doffer guard, — and various improvements in locking and packing, as well as in other directions. On the WHITIN we control the special fit of the bolster in its case, and the WOODMANCY doffer guard before mentioned. The MCMULLAN spindle

has full patent protection for several years to come. Our prices on all these forms will continue to be materially cheaper than those charged for any other form of spindle, value for use being considered. Exact differences in construction and patents which cover them, I will not go into here and now, for the reason that I have noticed a tendency to make my published remarks a basis for argument in patent litigation.

I cannot leave the subject without referring to a recent improvement made by Mr. RABBETH, the inventor of the yielding bearing spindle, which we think will prove of great value, and we believe that manufacturers who adopt it will find it worth several times its cost.

As spindles and bobbins are now made, the bobbin is driven by the contact of its tapering inner surface with the tapering exterior surfaces of the spindle and whirl. There are two of these so-called frictionally adhesive bearings; one near the top of the spindle and bobbin, and the other near the bottom of the bobbin, on the exterior surface of the whirl, or within a cup attached to the whirl. As spindles are run, it is seldom that both bearings are effective, and most manufacturers depend on one only. In practice, even one does not seem to be certain in action, as an examination of any frame of spindles carrying nearly full bobbins, will show. A large part of the bobbins will be found loose, in such an examination, and in that case there is a tendency to rise on the spindle, which must mean a more or less uneven twist in the yarn.

Further, owing to the shrinking and swelling of the wooden bobbins, there is a large variation in the height at which they stand on the spindles, particularly in the case of filling bobbins, which are wet more or less in the operation of conditioning the yarn for weaving, and hence swell and shrink unevenly. Half or three quarters of an inch is not an extraordinary variation in height for these bobbins in spinning, and that means a traverse half or three quarters of an inch shorter than is necessary, — a large reduction of the amount of yarn on each full bobbin, — and waste made from winding too high or too low on bobbins

that vary in position more than the amount allowed for in setting the traverse.

Referring only to the less amount of yarn on each full bobbin, made necessary by this defect, it is evident that it causes more frequent doffing and greater cost for doffing, — greater cost of spooling warp yarn, and more knots, (a great disadvantage), — more frequent changing of filling bobbins in the loom, with the additional work for the weaver which that implies, — and also an unnecessary number of blemishes in the cloth, there being a blemish in cloth woven on most looms at every change of filling. We shall have something to say on this subject later, in another connection.

Still further, if the bobbin seats itself firmly on one or both of these adhesive bearings, or is crowded down, as is frequently done to prevent loosening, its removal to piece an end, or in doffing, becomes difficult, and spindles are bent every day in your mills in wrenching them off. I need not enlarge on the disadvantage of bent spindles; — they mean bad spinning and serious cost for repairs.

To overcome these troubles, Mr. RABBETH has made a centrifugal drive, consisting of loose pieces attached to the whirl, which allow the bobbin to be put on or be taken off the spindle freely, when the spindle is at rest; but which spread by centrifugal force, and drive it by engaging its inner surface, when the spindle is in motion.

I repeat: When the spindle is still, its bobbin is perfectly loose, and when it is in motion the bobbin is sure to turn. This overcomes the trouble of uneven twist, caused by the loosening and rising up of bobbins as they are now driven. The bobbins in the new construction all come down to shoulders on the whirl, which stand in a horizontal line. This insures the same vertical position of all the bobbins, and enables the traverse to utilize their full length, instead of a considerable percentage less than their length, as now. The bending of spindles in doffing or piecing ends, will also be eliminated.

Still another point is worthy of mention. The new construc-

tion enables us to make a much more solid bobbin at the bottom, and to avoid to a great extent the operation of reaming bobbins, which is so troublesome in mills. The loose fit, by the greater leeway which it allows, ought to prevent reaming entirely, but so much water is thrown on filling bobbins, in some cases, that some reaming may still be necessary. It will, however, certainly be less necessary, and in many mills may be avoided altogether. We feel sure that the bobbin bill will be greatly lessened where this new drive is adopted.

Taken together, these advantages are enough to secure a considerable economy in spinning, as well as better work, and we believe that the improvement producing them is destined to come into universal use. We have tested the new device in quite large numbers, in various mills, and on coarse and fine work, and its performance seems equal to its promise. Orders have been received for many thousands of them, and we are prepared to furnish them with either the DRAPER, or WHITIN, or MACMULLAN spindles, at a reasonable extra price. We are also prepared to furnish spindles having whirls with centrifugal clutch, to replace or repair those now in use, it being unnecessary to change the other parts of the structure.

A reference to some of our processes recently developed, for making spindles, and I will close.

We have tried many and costly experiments to increase the stiffness of our spindle shafts, and to prevent their being set when bent. A very slight strain will bend a steel shaft a foot long and five-sixteenths of an inch or less in diameter. Up to a few years ago the mere shipping of spindles, in boxes prepared especially, bent and set a large proportion of the spindles, so that re-straightening was necessary; and this could not be done so well at the mill as in the process of manufacture. That is to say, the machines were started with some of the spindles slightly crooked, trusting to the RABBETH principle to make them run with fair steadiness. It goes without saying that straight spindles will run more smoothly, break less ends, and wear longer, than crooked ones, even if they are only slightly

crooked, and in our new processes we made a long step toward overcoming this difficulty.

In running the spindles, also, particularly in taking off bobbins which are firmly seated, spindles are sure to be bent, and it is important that they should spring back into place, rather than run crooked. Our centrifugal clutch, that I have before described, will prevent this bending almost entirely; but a stiff, springy spindle is desirable, even with that; and it is essential in the ordinary construction. We believe that our processes insure the best spindles made, in these particulars; and they are a part of the regular manufacture of all our spindles, — the cheapest as well as the most expensive.

Other processes, secured by patent, are embraced in our spindle grinding machines, which are unlike any others. I quote from patent No. 678,767, to CHARLES F. ROPER, assigned to us:

"It is the object of my invention to provide a novel mechanical movement which is especially adapted for converting rotary into an even and uniform reciprocating movement. Where the ordinary crank and pitman is employed for converting rotary into reciprocating movement, or vice versa, the speed of the reciprocating element varies at different points of the stroke and the said reciprocating element will dwell for a considerable length of time at the end of its stroke or when the crank arm is passing the dead-centre point. In order to avoid this difficulty I have connected the end of the pitman or other connection to the crank shaft by a connecting member which is in the nature of a differential crank-arm, the said crank-arm operating to give the end of the pitman to which it is connected a variable angular velocity, the angular velocity of the said end of the pitman having a gradually accelerated movement at the end of the stroke and a retarded movement during the intermediate portions of the stroke. Mechanism is also provided to cause the end of the pitman to pass the dead-centre point with a greatly accelerated movement."

This uniform traverse, enables the spindle to be moved past the grinding wheel, when cutting, at a uniform speed; or, if desired, at a uniformly varying speed. The result of irregular

speed of the traverse or of dwell at the ends of the traverse, is to grind irregular diameters. This device, therefore, enables spindles to be ground of uniform diameter, or of regularly tapering diameter, as may be desired, a very important matter, appealing to every mechanic.

I quote next from another patent of Mr. ROPER'S, No. 676,700, which is embodied in our machine:

"The embodiment of my invention herein illustrated comprises a machine which is especially adapted for grinding, shaping, and polishing spindle-blades such as are used in the textile art, though I would state that the invention is not limited to such use, but may be incorporated in any grinding machines which are used for shaping and polishing articles of varying diameter. As is well known, spindle blades are largest at their central portion and taper toward each end, and in use it is important that they should be smooth and of uniform size. The machine hereinafter described and which is especially adapted to accomplish this result comprises generally a grinding-surface, a work-holder, a templet for controlling the position of the work-support relative to the grinding or abrading surface, said templet corresponding in shape to the shape of the spindle blades, and mechanism for advancing the grinding surface toward the work-holder during the grinding process. The work-holder is shown as a reciprocating member, and my invention also comprises means for moving the work-holder back and forth in front of the grinding surface at a substantially uniform speed, so that every portion of the spindle will be subjected to the same grinding action."

The old method of grinding spindles was to begin at either end, and grind up to the center or largest diameter. This made two separate grinding operations, which never absolutely agreed and this made each spindle more or less imperfect. With the ROPER process the spindle being ground at one operation, must be substantially true with itself, and all the spindles must conform more nearly to the same standard.

One more substantial quotation, from Mr. ROPER'S patent No. 714036, will cover all that it seems necessary to explain:

"It is customary to point the ends of the spindle blade before grind-

ing, and such pointing has heretofore been accomplished by hollow mills; but certain objections pertain to such practice, and I have invented a grinding machine for shaping or pointing the ends of the spindle blade by grinding, and in the machine to be hereinafter described the movement of the blank during the grinding is automatically controlled, so that as the grinding progresses the desired taper is effected. I have also in the present embodiment of my invention provided for simultaneously grinding the opposite ends of the blank, and when a predetermined grinding has been effected the work is automatically moved out of the field of action of the grinding surface."

It is important that spindles of a given type should be, mechanically speaking, of one length, and that the points shall be true and round, and of the same taper, so that they will fit in the centers of the grinding machine. The old process of making these points was to cut them in a lathe with a chuck and tool. Our present process, above explained, is to grind the blanks between two emery wheels, which make them much nearer uniform in length, and in perfection of the bearing points. We can also leave the spindles harder, as it is not necessary when the points are ground to anneal the spindles, as is done when the points are made by a turning tool.

Beyond these patented points, our machines leave much less to the judgment and skill of the operator, and as a consequence the spindles produced are nearer uniform in diameter, and average more nearly round. As a result of all these advantages we have been able to make our spindle inspection materially closer, so that a very large percentage of spindles which formerly with the ordinary process we accepted and put into use, would today be thrown out, for various irregularities and variations from standard, while all the present spindles are materially stiffer, and have greater capacity of bending without setting.

We have also perfected our machinery and processes in making the cast iron parts of the spindle structure; also our assembling; to the end that standard sizes shall be maintained, and imperfect parts discarded.

We do not think it possible that anyone using only the ordi-

nary tools can make spindle structures as perfect mechanically, or as well fitted for their work, as ours; and though the RABBETH principle will allow of the running of more or less imperfect structures, such spindles will run less steadily, break more yarn in spinning, and come to repair quicker.

To summarize:

1. The manufacturing community owes to the initiative of our company the introduction of the SAWYER and RABBETH spindle inventions, which, as perfected, have halved the cost of spinning

2. Important features are still protected by letters patent, and we shall continue to supply the trade with spindles embodying them. The spindles that we have sold of recent years are of this character.

3. We commend to your examination and adoption the centrifugal bobbin clutch that I have described.

4. We have expended much ingenuity and large sums of money in perfecting our mechanical work in this direction, and believe that these expenditures will show themselves in our production, — whether of the dearer or cheaper spindles.

In closing I desire to thank you all for your intelligent cooperation in securing the universal adoption of these wonderful developments of the machine which

> "Draws and twists a thread,
> Without the tedious toil of human hands."

There is still room for great advance in the textile industry, and some such advances are being brought to your attention. I hope you will maintain the same progressive attitude toward them that you have shown heretofore. In this way, and in this way only, can America maintain the lead she has taken in improving and cheapening processes in all machine using industries.

General WILLIAM F. DRAPER. Gentlemen, I am sorry, as I intimated when I began, that I have been compelled to thresh

out in this article so much old straw. I feel that I have been repeating here what you know just as well as I do, and what perhaps needs no repetition, and the apology which I make is that I was asked to prepare a paper on this subject, and that after considering the present condition it seemed to me that it might be interesting to you, as it certainly has been pleasant to me, to make a kind of retrospect of what has been done in this art during the last quarter of a century. [Applause]. Mr. President, Mr. STIMPSON has some samples of these spindles with the special clutch that I spoke of, which he will pass about if there is no objection to his doing so.

The PRESIDENT. Gentlemen, the General's paper will be of very great interest to the spinner, and if there are any gentlemen here who would discuss the matter or desire to ask any questions, the General will be pleased to answer. I take it that General DRAPER has stated facts as they exist, making it almost impossible to open any discussion. I take it, General, that your remarks are so perfect and so complete that there is nothing more to be said about any of them. [Applause.]

General WILLIAM F. DRAPER. Mr. President, I am sure that you and the meeting are very kind to take that view. If any gentleman cares to ask me any question, I shall be very glad to answer it; it is no secret matter.

The PRESIDENT. The next paper in order, gentlemen is on "The Advantages of Rope Transmission in Textile Plants."

ADVANTAGES OF ROPE TRANSMISSION IN TEXTILE PLANTS.

FREDERICK S. GREENE, 65 Wall Street, New York City.

If there is one place above all others where Rope Driving predominates over either belt drives or electricity it is in textile plants, and especially in the modern cotton mill.

Electricity as a means of transmitting power for extreme distances and in scattered plants, particularly in mills where all the machinery is not in operation continually, possesses advantages paramount to all other methods. But in well-balanced cotton mills, such as our engineers are designing today, where the pickers are so numbered as to keep the cards in operation, they in their turn to supply the spindles, and finally the spindles to produce just sufficient yarn to keep all looms at work, — electrical transmission has not yet reached a sufficient stage of perfection, nor economy in installation, to justify its adoption.

Economy, therefore, is the chief advantage of a rope drive over electrical transmission, — but when compared with belt transmission there are a dozen or more points in favor of ropes. Those which apply particularly to textile plants may be summed up as follows: —

THE DISTANCE AND DIRECTION IN WHICH POWER MAY BE TRANSMITTED IS PRACTICALLY UNLIMITED. There are many rope drives now in successful operation where power is carried with economy a distance of from 200 to 500 feet. Where shafts are neither in the same line nor plane, by properly placing guide sheaves, power may be transmitted by ropes around corners,

from one building to another, and in short, between any two shafts, no matter how situated.

ECONOMY OF SPACE. The width of rim surface required for rope sheaves is from ½ to ⅔ that of the width necessary for belting, according to the size of rope used. The supporting bearings may, therefore, be placed much closer for a rope than for a belt drive, an advantage that the practical mill man will recognize as of prime importance.

The accompanying cut is taken from a photograph of a rope and belt drive now in operation. Here two 1¾" diameter ropes are transmitting 80 H. P. to the shaft, while the belt drive, immediately along side, is doing but 75 H. P. The difference in space occupied by the two pullies is an eloquent advocate for ropes.

FIGURE 1. RELATIVE SPACE FOR ROPE AND BELT DRIVE.

ROPE DRIVES ARE NOISELESS. This fact is due to the flexibility and lubrication of the rope, and to the air passage under it in the groove. There are many cotton mills in this country whose engines are developing from 1,000 to 2,000 H. P., where the faintest sound in the engine room can be distinctly heard, therefore, the slightest irregularity or disarragement in the running of any part of the engine can be detected at once.

NO ELECTRICAL DISTURBANCE IS PRODUCED. It seems hardly necessary to explain to cotton spinners what a favorable point this is for rope driving, as the electricity generated by belts has always been one of the most serious troubles in textile manufacture.

NO LOSS OF POWER FROM SLIPPING. Where the diameter of the rope sheaves is sufficiently large, and the angle of the groove properly turned, so that an air space is left under the rope, it wedges so firmly in the groove, that loss of power by slipping becomes a factor too insignificant to be considered.

TRANSMITTING POWER TO DIFFERENT FLOORS. As power in all modern cotton mills is transmitted to three or more floors, the advantages of rope driving for such plants is undeniable. The full number of ropes start from the driving sheave, while the number required for each different shaft are easily taken off at the several floors.

ECONOMY IN FIRST COST AND MAINTENANCE. In drives of 200 H. P. and up, where shafts are more than 30 feet centres, the cost of rope drives, as compared with belt or electricity is much in favor of the former. The advantage increases rapidly as the distance apart of shafts and the amount of power increases.

To arrive at an approximate cost of the maintenance of rope drives is a difficult matter, as it depends almost entirely upon the manner in which the rope is spliced upon the sheaves, and, where a good transmission rope is used, upon the ability of the man in charge, to let the ropes take care of themselves, and to refrain from coating them with all sorts of injurious preparations. The average life of rope on the main drive of a cotton mill, where the multiple or English system is used, is from eight to ten years, during which time, the entire cost of maintenance should be confined to the labor required to take up the slack in the ropes once, or at the most twice.

When estimating the maintenance cost of an electric drive, it is well to bear in mind that the equipment installed today is almost sure to be antiquated six or seven years hence. There are cases of record where mills were refused insurance until elec-

trical apparatus, put in but five years previously, had been replaced by appliances of later date.

To make a comparision of the first cost of the three forms of transmission, we will take for example, a three story mill developing 1,000 H. P., as shown by the accompanying cut which is from designs of a cotton mill now in operation. The engine wheel is 21 feet in diameter, 70 R. P. M. The three driven sheaves are each 64″ in diameter; 400 H. P. is taken off at the third or spinning floor; 400 H. P. at the second or carding floor; and 200 H. P. at the first or weaving room. Nine 1¾″ ropes are carried to the two upper shafts, and five ropes to the lower, as against two 40″ and one 20″ double belts.

If this arrangement may be criticised on the score that the belts are wider than strict necessity requires, it must also be admitted

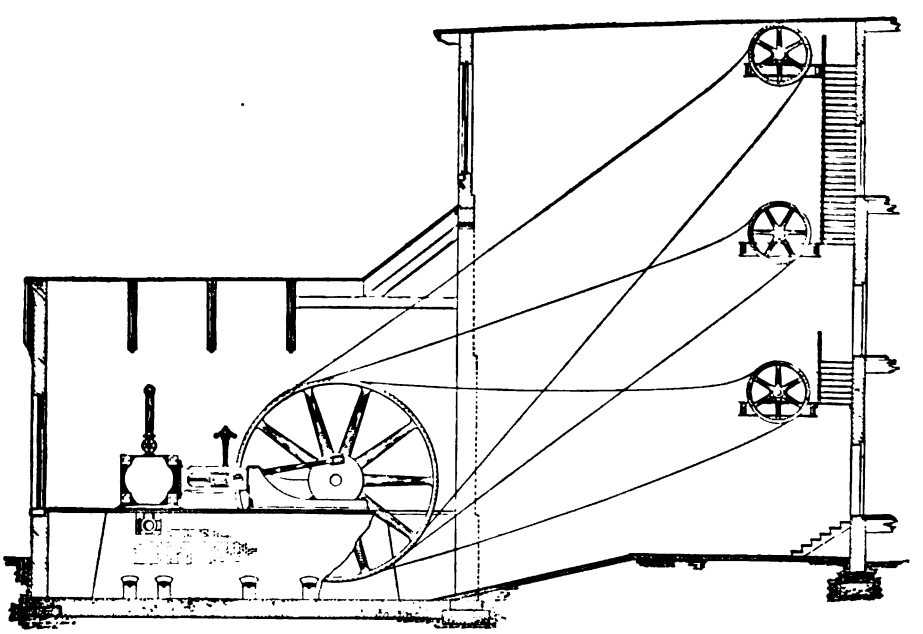


FIGURE 2. MAIN ENGINE AND DRIVE FOR THREE STORY COTTON MILL.

that the amount of work allotted to the ropes is equally conservative, for each rope is doing a little less than 44 H. P., whereas, the printed tables of some of the most prominent manufacturers of rope driving machinery give 65 H. P. as the amount of work to allow for a 1¾" rope running at 5,000 F. P. M. In making this comparison the writer has endeavored to follow as nearly as possible the methods used by successful mills of recent design.

For the rope and belt drive above described we have the following table of costs, due allowance having been made for material wasted in splicing in both cases. The prices for both rope sheaves and belt pulleys were quoted by one of the largest machinery manufacturers of this country.

RELATIVE COST. 1,000 H. P. BELT AND ROPE DRIVE.

ROPE SHEAVES.	BELT PULLEYS.	TRANSMISSION ROPE.	LEATHER BELTS.		
Driver 21' dia. 23 Grooves. 3 sheaves 64" dia.	Driver 21' 3 pulleys 64" dia.	1¾" diameter.	2 ply.	Total Cost of Rope Drive.	Total Cost of Belt Drive.
$4,400 00	$4,050 00	$541 48	$1,949 14	$4,941 48	$5,999 14

Width of RIM for ropes 58 inches; for belts 102 inches.

The effort to determine the cost of an electrical transmission for the above mill has not been entirely satisfactory to the writer, for each concern applied to for figures, has recommended different arrangements for the motors, — some advocating that the power be divided into units at many points, necessitating the use of a large number of small motors. But the cheapest arrangement that will meet requirements satisfactorily, seems to be to place two 200 H. P. motors on the second and third floors, with two 100 H. P. motors on the weaving floor. These six motors, together with a 750 K. W. generator, switch board and other necessary appliances, amount to a total of $25,400.

It would hardly seem necessary to go beyond these figures to prove the advantage of Rope Drives over either belt or elec-

tricity at the present time. We are told by our electrical friends that the day is coming, when each picker, card, spinning frame and loom will have its individual motor, but from present costs, we are forced to the conclusion that this day is in the far distance. And even were the question of cost not so important, the advantage of running individual machines in a cotton mill would not seem of great moment, for the writer is assured by successful cotton mill men that under present conditions a mill must be well balanced, and all departments in continual operation, to insure its success from the standpoint of dividends.

On the banks of the Savannah River in Georgia, stands a cotton mill which is driven by electricity, the power being rented from a company which develops it at a dam located about one mile further up the stream. In this plant the entire power is brought to a central motor, from which it is transmitted by ropes to the different floors. This mode of handling the power has proven economical and entirely successful. Now if it has been found advantageous to drive with ropes from one motor, avoiding small units, even where your electricity is generated by a water power, how can we be made to see the economy of generating electricity by steam and carrying it to a number of costly motors when both generator and motors are under the same roof?

It is not the purpose of the writer in this paper to enter that field of contention, as to which of the two systems of Rope Driving is the better, the Multiple or Continuous. In his opinion, both systems have their place — and the place where the Multiple System shows to best advantage is from the main drive of a cotton mill. Should it be necessary to design a vertical, quarter turn or other complicated drive, of course the Continuous System should be employed, regardless of the character of the plant.

As an example of the flexibility of Rope Driving with the Continuous System, the accompanying cuts are presented. These illustrate a drive recently installed in a woolen mill in this state. The distance between centres is but 16 feet, it being impossible

to procure more room in the building. And in this short space, a quarter turn drive is transmitting 200 H. P. from a vertical water-wheel, running 205 R. P. M., to the horizontal shaft of an electric generator with a velocity of 579 R. P. M. The actual distance between the circumferences of the driving and driven sheaves is but 10 feet in the clear. Furthermore the old rule that the smallest sheave must not be less than 40 times the diameter of the rope, has been violated, for, in order to procure the required number of revolutions at the driven shaft, its sheaves could not be more than 34″ in diameter. On this drive, ten 1 1/8″ ropes are running at a speed of 5,150 feet per minute. In spite of these disadvantages this rope drive has been in successful operation for many months. It is probably the shortest quarter turn drive ever erected, and is a striking example of the flexibility and advantages of rope drives in solving difficult problems in the transmission of power.

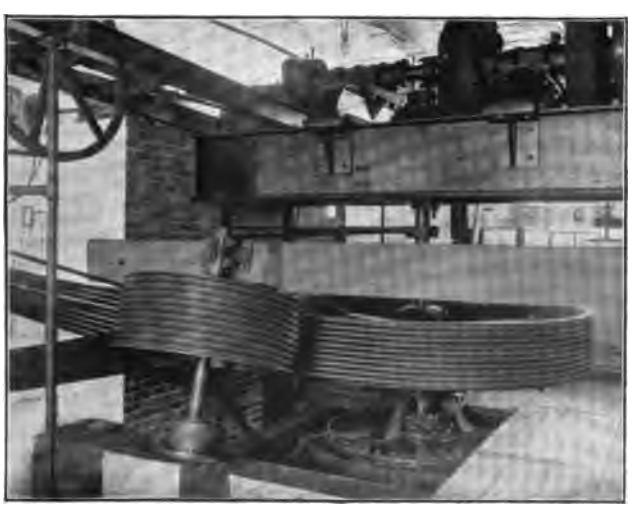


FIGURE 3. DRIVING SHEAVE AND DEFLECTING IDLER.

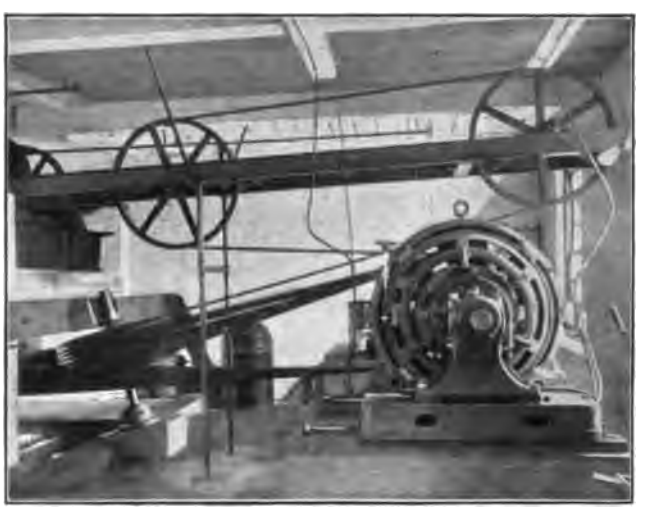


FIGURE 4. TENSION CARRIAGE AND DEFLECTING IDLER.

Mr. EDWARD W. THOMAS. In the paper just presented by Mr. GREENE, I believe there are statements made therein not justified by actual existing facts. In the opening statement of the paper he states that:

"If there is one place above all others where rope driving predominates over either belt drives or electricity, it is in textile plants, and especially in the modern cotton mill."

During my experience as a manufacturer I have had opportunities in the operating of mills equipped with rope drives, belt drives and electric drives, to see the benefits as well as the objections to each plan. In all of the mills which have been operated under my supervision that were equipped with the rope drive, say from engine pulley on to the head end shafts of the various rooms, from main water-wheel shaft to head ends in mill, it has been as practical to drive with belts and with equal advantage. Ropes do require more attention than belts and while the first cost may be less, it is a very serious question whether or not the operative expenses are not greater in a ten years' run than with belt drives to do the same work. Particularly is this so under the English system of individual ropes. There is also more or less trouble experienced in properly splicing new ropes, or taking up old ones. I freely admit there are places where if electric drive is not to be adopted, the rope drive is more fit to the case than the belt drive. If rope drive is so superior to belt drive, why is it not adopted in our carding, spinning and weave rooms for the ordinary counter belts, and have the belting in mill confined strictly to that driving the individual machines.

I have today under my management a spinning and carding room thus fitted up with rope drive and it is a source of constant annoyance as compared to the belt drives in similar rooms in same mill and adjacent ones.

I must also criticise the implication that the course pursued now is to fit up the modern cotton mill with rope drive instead of either belts or electric drives. Facts disprove this state-

ment, as note, that in the South where today the more recent mills have been built, they are all practically belt driven or electric, the latter I think predominating. Not only this, but many of the older mills that have been driven with belt drives are now stopping their engines and buying their power from electric power plants. Of the modern mills lately constructed, I refer to the Soule and Butler Mills of New Bedford, Mass., the White Oak Company at Greensboro, N. C., the new Highland Park Mill, at Charlotte, N. C., the Olympia, Buffalo and Lancaster Mills, South Carolina. All these mills carry over 50,000 spindles each and all represent the most modern type of cotton mills. Each of the above is driven throughout electrically. These mills were designed by some of the most eminent mill engineers of today.

Following on with the different headings in Mr. GREENE'S paper, which are the basis of his statement, at the beginning of the article he says:

"The distance and direction in which power may be transmitted is practically unlimited."

So is electric power, to a distance of many miles.

"Economy of space."

Electric drive is more economical than rope or belt drive.

"Rope drives are noiseless."

So is electric drive, and the slight noise made by running belts is not at all objectionable.

"No loss of power from slipping."

On this point I think that, lacking published information or the results of tests for a reliable period, I should doubt the statement. Actual facts lead me to think there is a slippage and a very considerable one.

"Transmitting power to different floors."

So also is power transmitted to different floors by electric motors and in hundreds of mills today by belts.

A point raised by Mr. GREENE in criticism of the electric drive that "any electric equipment put in today would be sure to be antiquated in 6 or 7 years hence," I don't think is sound reasoning, as the experience of mills that have had the electric drive in successful operation for the past nine years to my personal knowledge have expended but very little if any money for repairs. If the reason given were so, that an electric plant put in today did need renewal, it is my opinion that if better form of generators or motors were in the market at the end of the seven years quoted by Mr. GREENE, the mill owners would be willing to put in the new for the antiquated. Cotton mill men are often called upon to throw out machinery after possibly being but little used, when they find machinery more economical to operate. It has become a feature of ethics in operating a mill today, that one has to "spend money to make money."

The simple point raised by Mr. GREENE where mills were refused insurance on account of electric apparatus put in but five years previous, I have no doubt is true. This does not imply by any means that electric driving is not acceptable to them. In fact, where the wiring is done according to their specifications and the operative portion is standard make, no objection is raised to any mill adopting electric driving.

Finally it seems to me that Mr. GREENE has shown rather a slight acquaintance with what has been going on in the textile fields in the line of mill driving, as evidence is very manifest to a large degree that many manufacturers have willingly staked their success on electric driving rather than upon rope driving. Why?

In England, the home of rope driving, considerable interest is being manifested in the subject of electric transmission and I subjoin an extract from a paper recently read in Bradford, showing to my mind very conclusively that the manufacturer has awakened to the fact that there is a better means of driving than by means of ropes or belts.

ELECTRICAL TRANSMISSION.

(From a paper read in Bradford, England, by GEO. W. BOWDEN.)

The efficiencies of a plant driven electrically are so favorable in comparison with any other method of drive, that all new works being constructed should be laid down on these lines, and such has been the progress made during the last few years in this country that very few of the works and new industries lately started, or now in course of construction, are holding to the old methods, but are at once laying down a modern generating plant, as they see that the first costs compare very favorably and the efficiency of the plant is so much higher. Moreover, in designing new works engineers are no longer handicapped, as in the old and less convenient method. They have no longer to consider how they can squeeze in their machinery and work it in around the power.

It is no longer a question of bringing the work to the power. The work and various operations can be carried out in the most convenient and useful situation, a couple of wires being all that is required to run to a certain spot, and there the motor or motors are installed. The engineer will arrive at the powers required in the generating station by giving due consideration, as before mentioned, to any possible future extensions, power required for lighting, and having estimated the powers in his various motors will thus arrive at the total power required in the generating station.

The nature of the work has then to be considered as the means of deciding how this power will be divided."

Mr. FREDERICK S. GREENE. Mr. President, in reply to the criticism upon my paper. The gentleman says that I know very little about the recent installations in the cotton mills. That may be true — I am not a cotton mill man, but he certainly knows very little about the paper that he is discussing. I took the trouble to put in a whole paragraph in which I said that economy is the chief advantage of a rope drive over electrical transmission, but when compared with belt transmission there are a dozen or more points in favor of ropes, after which I went on to enumerate the advantages of a rope drive over a belt drive. He goes on to say that I have committed a terrible

crime here because I say those advantages exist over an electrical drive. I do not; I simply say that economy is the one point of advantage over an electric drive. He evidently missed that whole paragraph or did not take the trouble to read it.

Now, he makes the bald statement that ropes require more attention than belts, that they are difficult to splice. Ropes on a bad rope drive may require and do require more attention than belts on a good belt drive; but a good rope on a good rope drive will not require as much attention as a good belt on a good belt drive. Furthermore, it is a great deal more trouble to take off and cement a wide double belt than it is to re-splice a rope.

He asks, "Why is rope driving not adopted for counter drives in cotton mills?" That is a question I am asking. Then he goes on to say that in his own mill he has a great deal of trouble with his counter drives. I don't know the gentleman, but I have just been informed what mill he is in, and I have seen the drives he speaks of, and I am not at all surprised that he has a great deal of trouble. He is using antiquated cotton rope, to begin with, or was the last time I saw it, and the sheaves could be considerably improved.

Then he says that the statement that more mills are being equipped with rope drives than with electricity is not so. Well, we have with us a very distinguished mill engineer, Mr. C. R. MAKEPEACE, and I am going to ask him to answer that. From the best information that I could get in discussing this subject with several prominent mill engineers, they told me that they had more orders on their books for rope drives than they had for both belt or electricity put together. When an old conservative mill like Pepperell Manufacturing Company at Biddeford, Maine, puts in two rope drives in the last two years, it would appear as if rope drives were coming in.

Then he speaks of the SOULE mill. I had occasion to talk with the designers of that mill, and was told that electricity in that particular instance was by all odds the most advantageous mode of transmitting power. I do not pretend to say

that rope driving is the most advantageous for every cotton mill, but I say for the average cotton mill that it is. I would like to hear from Mr. MAKEPEACE on the subject.

Mr. CHARLES R. MAKEPEACE. Mr. President, I have nothing to say in the discussion of this paper, but if I was called upon to choose between a rope or a belt drive for the distribution of large powers, I would select the rope in preference to the belt.

Mr. J. R. MONTGOMERY. Mr. President, I am sorry that Mr. THOMAS in his article of criticism did not go into the question of relative cost. The relative cost as shown here between the rope and belt drive as compared with the electrical drive seems to me to be something enormous, and it does not agree with some information which I have recently obtained, and I would like to hear a little more upon that point, and just how the cost is made up — whether any allowance was made in reckoning the cost for the necessary use in a rope or a belt drive of valuable space in the mill. These are some points which I would like to hear cleared up a little, and I presume there are practical men here who can give us some light on that subject.

Mr. SIDNEY B. PAINE. Mr. President, I must agree with Mr. THOMAS that the writer of the paper under discussion is not very familiar with the electric drive. On the first page the writer states: "In well balanced cotton mills, . . . electrical transmission has not yet reached a sufficient stage of perfection, nor economy in installation, to justify its adoption."

This is surely very interesting as his opinion, but it is quite at variance with that of at least a score of manufacturers whose names I might mention. Personally, I know of sixteen (16) new cotton mills which have been erected in this country where the motive power has been a steam engine and where the electric drive has been used in preference to a rope or a belt transmission. This has not been the work of one engineer only, but

eight (8) of our best mechanical engineers in this country have decided that under the conditions existing in these sixteen mills, and it is possible that they cover nearly all conditions, the electric drive was better. In fact, the writer of the paper in answering the criticisms by Mr. THOMAS admits that possibly in the Soule Mill, in New Bedford, it was the better course. That mill was no different from any other mill. They owned a piece of real estate on which they wished to erect a factory, and they had the water in close proximity for condensing and even under those conditions the engineers decided that it was better to put in the electric drive than the rope or the belt transmission.

There is another question: If this system is so imperfect or so undeveloped, it is rather singular that such concerns as the Amoskeag, the Lancaster, the Bates and the American Woolen Company should have increased their initial plant. If we assume that all these parties make a mistake once, each has increased its electric plant two and three times, and it is singular that they should have done so if they were in error at the outset.

The paragraph at the bottom of the third page is very ambiguous:

"When estimating the maintenance cost of an electric drive, it is well to bear in mind that the equipment installed to-day is almost sure to be antiquated five or six years hence."

There is a distinct statement, and in support of it another statement is made:

"There are cases on record where mills were refused insurance until electrical apparatus, put in but five years previously, had been replaced by appliances of later dates."

I fail to see any connection whatsoever between those two statements. I do not know what connection insurance has with "antiquated apparatus," unless the writer of the paper uses "antiquated" in the sense of "unsafe" apparatus. Of course, under those conditions insurance companies would have something to say, and undoubtedly, if unsafe wiring appliances were

used the insurance companies ought to interfere, but they ought to have found it out inside of five (5) years. But it is unfair to condemn the electric drive because some contractor has used some unsafe wiring device, as it would be to condemn the belt drive because some contractor has used poor belt lacing or to condemn the rope drive because in making a splice the same contractor had done poor work.

The president of this Association has three (3) dynamos which I had the pleasure of selling his concern twenty-two (22) years ago, and I think the current from those dynamos is just as good as from those which are sold today. The dynamos are not so handsome, they are not so well finished, they are possibly not quite so efficient as those we are selling to-day, but they are doing their work and doing it effectively. Our president is a progressive man and he has not thrown them out yet. They are of age and yet they are good for some time to come. I fail to know of a single case in the ten (10) years that the electric drive has been before the public where a single plant has been rejected by the insurance companies on account of trouble with the apparatus.

The Page Belting Company, manufacturers of belting in Concord, who are using the electric drive, informed me last year that their repairs had cost practically nothing.

The Lancaster Mills, in Clinton, also reported last year that they had spent nothing for repairs for their plant of 4,000 horse-power motors during five (5) years service.

The Columbia Mills, of Columbia, S. C., have been running nine (9) years this month, and their motors and generators are in as good condition as when we put them in, as far as we can see.

Now, in regard to the question which has been raised by Mr. MONTGOMERY as to the cost. On this subject the writer of the paper under discussion has selected two items, the cost of the sheaves, and the cost of ropes, and has compared their cost with the *entire* cost of an electric plant. I think that is hardly a fair thing to do. Assuming that the belt tower is 15 feet wide

and the mill 120 feet wide and three stories high, and assuming 60 cents per square foot as the value of the floor space, the rope tower would cost over $3,000 which the electric drive would save by doing away with the rope tower, to say nothing of the foundation, nothing about the end wall of the mill, simply the average of 60 cents per square foot. He has omitted all reference to the saving in shafting. It is impossible to state any figures on this item. The shafting in an electrically driven mill is practically uniform in size, being determined by the distance between the hangers. In the mechanically driven mill, however, the shafting increases in size very rapidly as the size of the mill increases, and, therefore, the saving in the electrically driven mill would be correspondingly increased.

He has said nothing about the lighting dynamos. In a mechanically driven mill, where electric lights are required, the lighting must be provided by special dynamos. These are not required in the electrically driven mills. We never make such provisions for the lighting in a cotton mill; in a woolen mill it is necessary, but in a cotton mill we have simply to light it up for the two hours between four and six, and the overload capacity of the generator is sufficient to take care of the lighting. It is impossible to estimate the saving in figures, but it is quite an item. So that all these items added together will reduce materially the difference between the two systems of driving.

I do not intend to maintain that the first cost of the electric drive is less than the cost of the rope drive in the mechanically driven plant in a mill of the size under discussion. Not until you reach nearly double the size of that mill do you find the lines cross. On a mill requiring 800 horsepower, you will find that the first cost of the electric drive is greater than that of the mechanical. As the size increases the cost curves approach each other. But the first cost is not the only thing considered. If it were we might hire novices to buy our goods. I think possibly old flat top cards might have been running today instead of the revolving cards, if first cost only had been considered. Many of these appliances that are considered neces-

sary would not have been adopted if it has been a question of first cost only. No, the manufacturer today says that the best is none too good. He determines what is best and then buys that just as cheaply as he can.

Referring to the next page, I note that his "electrical friends" have informed Mr. GREENE "that the day is coming when each picker card, spinning frame, and loom will have its individual motor." But that day is extremely far distant, in fact, no electrical engineer who knows anything about textile machinery would have made such a prophecy. In so far as we can see at present, the time will never come when it will pay to drive all these individual machines in the cotton mill by separate motors. Silk mill driving is different, I am not referring to that here.

Now, in regard to the mill on the Savannah River in Georgia. The method adopted in that mill is followed, I think, in two other mills. It is a very unusual method and brought about by very unusual conditions. All of the stations which have adopted that policy are the work of one engineer, who, for reasons of his own, made such restrictions as to bring about that method of driving rather than the sub-divided drive. In each of these places the induction motor is charged more for current than the synchronous motor, consequently one large motor was used to drive the mill. But that method is not a proper way of driving; it only perpetuates the mechanical drive with all its evils and gives you none of the benefits of the electric drive.

The PRESIDENT. Gentlemen, as there is no further discussion in reference to this matter, I would like to state a fact. I presume that most of you are aware — some of you probably may not be aware — that, almost without exception, every cotton mill in England, in Russia and in India, is driven by ropes. I merely state the fact, gentlemen, which surely should have some influence in one's mind as to the advantages or disadvantages of the different systems.

The next paper, gentlemen, is by Mr. EDWARD N. VOSE,

Our Consuls on Export Markets for Cotton Goods, which is an extension of the valuable paper on Export Markets for American Cotton Goods* read before the Association by Mr. VOSE a year ago.

In the absence of the author, the paper will be read by the Secretary.

* Transactions, Volume 74, page 422.

OUR CONSULS ON EXPORT MARKETS FOR COTTON GOODS.

EDWARD N. VOSE, Editor, DUN'S REVIEW, International Edition,
290 Broadway, New York City.

The New England Association of Cotton Manufacturers is to be congratulated on the energy and persistence with which its officers have followed up the suggestion made a year ago relative to an extended investigation of export markets for American cotton goods. The proposition met with immediate favor and at the Lenox meeting resolutions were passed requesting the Department of Commerce and Labor to call upon American Consular officials in all parts of the world to prepare detailed reports regarding the market for American cotton goods in their respective districts. Since that meeting, under the direction of your able Secretary, an excellent series of questions has been prepared, to be sent out by the department in connection with the request for this information, and there seems to be every reason to believe that the result will be a series of reports of unusual interest and value.

Through the courtesy of your Board of Government, I was favored last year with some 200 copies of my address on "Export Markets" and it occurred to me that perhaps the best use to which these pamphlets might be put would be to mail them to our consuls. This was accordingly done, each being accompanied by a brief letter of appreciation of the good work our consuls are doing and of reminder that few subjects are of greater importance and interest than the international

market for manufactured cottons. The result was somewhat surprising. Instead of a few perfunctory letters of acknowledgement I received scores of cordial communications, some of them confidential, but most of them going frankly and freely into the subject and containing a wealth of suggestive information and advice. I have felt that this valuable material ought to be utilized and on reflection came to the conclusion that it could not be better employed than as a sort of introduction to the more extended and elaborate reports which your Association is about to elicit. I have always felt, and I am sure that every member of this Association will agree with me, that a line of actual fact from an observer who is on the ground, is worth a whole chapter of theorizing from one at a distance. These letters consist exclusively of facts, there is no theorizing and no guess work.

It only remains to direct attention to the extracts from the letters themselves, which follow. Many of them are exceedingly full and clear, while in the shorter ones will frequently be found some pertinent observation or suggestive fact well worthy of the attention of our manufacturers. While the replies have been arranged geographically as a matter of convenience, it is only fair to our able consuls in the districts not represented in this brief symposium to state that as no replies were solicited their silence should not be taken as an indication of lack of interest in the subject on their part. On the contrary, a great number wrote hearty letters of approval which they expressly requested not to have quoted for publication. It is to be hoped that every member of the Association will take the time to read these letters in full. Those of Mr. HALSTEAD, our Consul-General at Birmingham, Consul-General MASON of Berlin, and Consul-General WORMAN of Munich, although brief, each contains some pertinent and valuable suggestion. The letter of Consul-General GUENTHER of Frankfort-on-the-Main, merits the careful attention of every American business man who is seeking American trade abroad. All of the Swiss letters are interesting, as are also those from Persia. Attention is also

directed to the admirable series of letters from India, the world's greatest market for cotton goods, and also to the valuable letter from Consul-General WILLIAMS from Singapore, the gateway of the rich markets in the Dutch East Indies. The letters from Africa are also extremely valuable and particular attention is directed to the very able and exhaustive report by Mr. HOLLIS, our Consul at Lourenço Marquez, which furnishes more information on the subject of the cotton goods trade in that district than the writer has ever seen before. This report is also suggestive as indicating the lines along which similar reports in the future should be prepared.

With this brief introduction to the letters themselves, the writer also desires to incorporate a renewed expression of his appreciation of the quality of the work our consuls are doing for American trade in every part of the world. No nation is served by an abler, more loyal, or more painstaking body of men and certainly this great Association cannot do better than to follow their guidance into the vast foreign markets for its products. If the elaborate and comprehensive reports with which I am confident you will shortly be provided as the result of their labors are carefully studied by the members of this Association and effectively acted upon, I have no question but that the foreign demand for your surplus product will be greatly and permanently enlarged.

EUROPE.

GREAT BRITAIN.

Mr. MARSHAL HALSTEAD, the American Consul at Birmingham, wrote in part as follows: "You are aware, of course, that I am not in the field where much work can be done in promoting the sale of American cotton goods, and I think, in fact, that we lose a good deal by our tendency to do a hit-or-miss sort of export business with competing countries, and in cotton manufacture, this is, of course, a competing country. I know one of our big print houses made an investigation here and they

found that because of excellent quality and novelty of design they could sell some of their best cotton prints in this market, but the methods are so different they concluded that they could not afford to come into the market. They would have to stock goods and sell by the single case instead of the 25 or 50 cases. It means simply that no one establishment of the kind could do anything here, but if a number of manufacturers, with different lines of goods, were to band together and establish a selling agency and provide these agents with stock and properly work the market it might pay."

Mr. WILLIAM HARRISON BRADLEY, our Consul at Manchester, Mr. LEWIS DEXTER, our Consul at Leeds, and Mr. JAMES BOYLE, our Consul at Liverpool, in acknowledging the receipt of the address, stated their readiness to do all in their power to furnish information regarding the market for American cotton goods in their respective districts if specific questions, such as have now been prepared by the Association, were sent out through the Department of State.

FRANCE.

Mr. WILLIAM A. PRICKITT, the United States Consul at Rheims, in a very cordial letter, warmly endorsed the proposal to secure detailed reports from our consular representatives throughout the world on this important subject, adding, however, that, "It is to the Orient and those countries which are not in a position at present to manufacture for themselves that we must look for an outlet for our surplus cotton goods in the immediate future. We are practically barred out of France by a high tariff and cheaper labor, and England may soon put up a tariff wall also."

Mr. ALLAN MACFARLANE, the Deputy-Consul-General at Marseilles wrote in the absence of Consul General SKINNER acknowledging the address and stating that "A large market already exists in Abyssinia for American cotton goods, though the commerce thus far has been in foreign hands, but I hope

we may look to a considerable extension of this business as a result of the mission at present seeking to stimulate the relations of the two countries."

Mr. BENJAMIN H. RIDGELY, our Consul at Nantes, also wrote briefly expressing his interest in the subject.

GERMANY.

Mr. FRANK H. MASON, our Consul-General at Berlin, wrote in part as follows: "There does not seem to be in Germany much chance for American cotton in any form except the crude raw staple on which the vast, varied and highly developed cotton manufacturing industry of this country mainly depends. Whether our southern mills can produce staple goods like sheetings or the white fabrics for calicoes, etc., cheaply enough to stand export through the tariff in Germany, is a question of arithmetic which only an expert in the trade can properly investigate and determine. Berlin is no cotton market or seat of cotton manufacture, nor is there any chance here for an adequate study of the subject."

The United States Consul-General at Munich, Bavaria, Mr. J. H. WORMAN, wrote; "Regarding the inquiry you make as to what can be done to stimulate the manufacture of American cotton goods abroad, I can only say that we shall gladly co-operate with you so far as it is within our power to do so, and if you will make specific inquiries we shall always be glad to answer them. It is to be regretted that the trade does not pursue its inquiries through its own representatives, which once done would bring results which must be successful within the German territory as well as elsewhere. I am quite sure that the effort made at Chemnitz would be a greater success were it seconded by efforts elsewhere."

In a later letter Mr. WORMAN forwarded the following interesting report on the cotton goods industry in the Augsburg district, prepared by Mr. G. OBERNDORF, the United States Consular agent there:

[Translation.]

CONSULAR SERVICE, U. S. A.

AUGSBURG, November 19, 1903.

Hon. JAMES H. WORMAN,
U. S. CONSUL-GENERAL,
Munich.

Dear Sir:

"In reply to your enquiry relating to the manufacture of cotton goods, the Mechanische Baumwoll Spinnerni & Weberi, Augsburg, writes: In reply to your favor of the 17th we have to say: 1st. That in our mills are made nearly all the cotton goods which are in this market. 2nd. The machines in use are from England and America.

The Mechanical Weaving Mill in Muehlbach-Pfersee, Augsburg, writes: In this district, Schwaben-Neuburg, are made principally one-colored goods, calico, coarse and fine, two-fold pieces, rough surface, Kattune, different sort of shirt-goods in quantities. Besides this there is some weaving of colored stuffs in large quantities.

The Jacquarel weaving mill does not manufacture very much. The manufacturing is done nearly exclusively by machines. The hand-weaving and home-industry has stopped with a few exceptions. The weaving and preparatory machines are mostly from England. The American NORTHROP weaving-machine, which came into existence some years ago, did not have much success here and there have been only a few trials made with it. Only recently a large weaving-mill of this place has put in about 300 looms or is about to do so. A result of this experiment can only be expected in the course of the next year. In fact whether this loom is suitable for the German industry has to be found out first by experiments. In this spooling department the Haemig patent machine for cleaning the threads is used all over with great success. From my own knowledge and from information I have received I can state that pretty near all the cotton establishments in my district are at present fully engaged and are enjoying a high degree of prosperity. They are nearly all well equipped with improved machinery and enjoy the benefit of cheap labor and ample water-power, and can thus produce cheaply.

For these and other reasons I do not think it likely that American cotton goods could compete successfully in the markets of South Germany."

I am,

Yours respectfully,

(signed) G. OBERNDORF,

U. S. Consular Agent.

Mr. RICHARD GUENTHER, United States Consul-General at Frankfort-on-the-Main, in acknowledging the receipt of the address wrote in part as follows: "I have read your paper with great interest and the views you hold as to the best plan to stimulate a demand for American cotton goods abroad coincide with those I have held for many years with reference to almost all other goods of American manufacture and which I have frequently expressed in my report to the state department and to individuals and corporations in the United States. Germany imported in 1902 nearly four millions of dollars worth of cotton cloth, which came almost exclusively from England and Switzerland. I am of the opinion that a part of this trade, at least, could be secured by our manufacturers if they would take the proper steps, such as you have so well pointed out. It would seem to me that any intelligent commercial man would readily see that this is the only practical way of accomplishing results.

I add for your information a statement of imports of cotton cloth into Germany during the year 1902.

1.	Cotton cloth, not bleached,	Mark.	10,988,000
2.	" " bleached,	"	1,925,000
3.	" " dyed, colored, stained, etc.,	"	3,409,000
		"	16,322,000

Of which Great Britain furnished of

	No. 1.	Mark	6,144,000
	" 2.	"	1,437,000
	" 3.	"	2,425,000
		"	10,006,000
Switzerland of	" 1.	"	4,594,000

Balance not enumerated.

I sincerely trust that our manufacturers will see the force of the suggestions advanced by yourself and others, and thereby increase the chances for both American labor and American capital."

Mr. GUENTHER appended to his letter an interesting report made by him on the general subject of developing the American trade in Germany which was published in 1902 but several paragraphs from which merit reproduction here.

The principal causes which at present seem to prevent further development of trade between the United States and this consular district are:

1. The general depression of trade in Germany, which has existed for nearly two years and which will probably last for some time to come, although the worst seems to be over.

2. The faulty methods employed by most of our manufacturers to secure and maintain the German trade.

I am quite sure that these reasons apply to the American commerce with reference to the whole of Germany.

It may be stated as a general truth that any article of manufacture which finds a ready sale in the United States will sell in Germany, provided it is placed before the public in a proper way and at a reasonable price. American goods are usually looked upon with favor by the general public here, although rival German manufacturers often try to disparage them. While the new German tariff soon to be enacted will raise duties all along the line, still I believe that many American manufactures will be able to compete here with German goods and those of other countries in the German market.

I do not believe, however, that sporadic efforts to introduce American goods will meet with success.

It will not do for an American manufacturer to expect a paying and lasting trade here unless he first carefully looks the field over. No Consul or commercial man who is not an expert in the particular line is qualified to give an opinion with reference to a particular article which would warrant the American manufacturer to embark in export trade to Germany.

If an American manufacturer comes to the conclusion that he is so situated that he at all times will be able to promptly supply the German

market with his goods, and believes that on account of the superiority of his manufacturing facilities he can compete with German and other products in Germany, he should then, before doing anything else, either come here himself or send a reliable expert in his line to study the situation on the spot, looking into the rates of transportation and of duties, finding suitable houses to act as his agents, etc. The comparatively small expense of such a course will cut no figure if he succeeds, and even less so if he sees that the business promises no profit, for he will thus save money in the end.

My advice to every prospective American exporter to Germany, and for that matter to any other country, is to "go slow," first acquaint himself with all the conditions of the market, to carefully look up suitable agents, have the necessary contracts drawn up by reliable German attorneys in conformity with the existing laws, and make preparations, if it is decided to engage in the business, to be able at the shortest notice to supply what is needed by the German customers. I have frequently heard complaints by Germans handling American goods, that their patience and that of their German customers has been sorely tried by the dilatoriness of the American firms to ship further supplies, and not infrequently the German customers became so disgusted that they gave up dealing in American goods solely for this reason, and handled afterwards only German or other goods which, although perhaps affording a lesser profit, could be supplied on short notice. There are many articles of American manufacture which would command a ready and profitable sale if the precautions I have tried to indicate would be taken.

Mr. J. T. MONAGHAN, United States Consul at Chemnitz, promised to send any special information regarding cotton goods opportunities that may come to hand, adding, "I believe that South America, Africa and Asia, offer almost boundless opportunities for the man who stops at no barrier, and knows how to make the best of every advantage."

Mr. ERNEST C. MEYER, the United States Deputy-Consul at Chemnitz, stated that in that "Mecca for Oriental knit goods buyers, one learns to appreciate the absolute necessity of a scrupulous investigation of all distant markets. This Germany does to perfection and her strong foot-hold in the far East most eloquently vindicates her policy, and ought to bring home

to American manufacturers of cotton goods, its wisdom and value."

Mr. BRAINARD W. WARNER, Jr., United States Consul at Leipsic, stated that he was about to make a report on the subject suggested and Mr. J. WHITE, United States Consul at Hanover, promised to forward all available information as secured. Mr. WARNER stated that wholesale prices. c. i. f., New York, Baltimore, Boston, etc., in meters of a few of the cheapest grades of cotton goods most likely to compete successfully with such goods from England, Germany, Austria, etc., would be of assistance and it might be worth while for the Association to forward, in connection with its list of questions, some such price list for the confidential use of our consuls in preparing their reports.

AUSTRIA–HUNGARY.

Mr. FRANK D. CHESTER, United States Consul at Budapest, Hungary, directed attention to his recent reports to the department of State, several of which discussed markets for cotton goods in his district.

SWITZERLAND.

Mr. HORACE LEE WASHINGTON, United States Consul at Geneva, enclosed in reply the following statistics regarding imports and exports of cotton goods in Switzerland for the year 1902.

No. of tariff.	Articles.	1902. Total for Switzerland. Imports. Frs.	Exports. Frs.
499 and 501.	Plain tissues unbleached	10,260,640	4,493,631
502 " 503.	id. bleached	716,600	2,487,530
504 " 505.	Dyed yarn tissues	1,178,150	5,379,750
506 " 507.	Dyed tissues	2,075,575	4,934,301
508 " 509.	Printed tissues	2,627,460	7,980,822

		Total for the United States. Imports Frs.	Exports Frs.
499 and 501.		4,680	268,774
502 " 503.			596,256
504 " 505.			211,723
506 " 507.	id.	1,880	115,550
508 " 509.			

A correspondent at Basle, to whom a copy of the address was sent, contributed the following interesting letter of comment: "I heartily endorse the proposed investigation, but that American cotton manufacturers can ever find a valuable market in this country I am at present much inclined to doubt. Half of Switzerland's exports to the United States, as you are aware, are cotton goods, while we on our side, only send in return something over half of the raw material they employ in this branch of manufacture. The fact is that this wonderful little republic, situated far in the interior of Europe, without iron or or other raw material, and not producing nearly enough food for its own consumption, must live by its industry or perish. So nearly all its imports are food products and material for its mills and factories, while far the greater part of its exports are manufactured articles. Of these, manufactured cotton embroideries are among the most important while cotton-spinning has also taken a great development. The export of cotton tissues is twice as great as the import, England supplying the tulle, muslin and cambric which make up just half of the latter. I suppose that these imports from England, amounting last year to about two and one half million dollars after having reached their maximum with a little over three million dollars in 1900, constitute nearly all the Swiss cotton trade which we have even the remotest prospects of partly wresting from our competitors. There are many things, including some manufactured articles which the Swiss must and do buy of us but at present it seems to me that cotton goods are not among them.

Mr. HENRY H. MORGAN, United States Consul at Lucerne, wrote in part as follows: "In reply to your inquiry with regard to a market for American cotton goods in Switzerland, I beg to

inform you that in my opinion there is no opening for such trade. The manufacture of cotton goods is one of the principal industries of Switzerland, which is easily seen by the fact that the exports of this class of goods from Switzerland in the year 1902, amounted to $35,000,000 or about 20 per cent. of the total exports. Of this amount the United States received nearly $11,000,000 worth, sending in return to Switzerland $3,000,000 of raw and $8,000 of manufactured cotton. Notwithstanding the fact that England is considered to be the principal cotton manufacturing country, the trade between England and Switzerland in cotton goods shows a balance in favor of the latter of over $2,000,000. Although the United States has the advantage of producing the raw material on the spot, I am inclined to think that it would be impossible for us to compete with the cheap Swiss labor and high tariff."

RUSSIA.

Mr. HERNANDO DE SOTO, the Vice and Acting Consul-General at St. Petersburg, states: I have read the address delivered before the New England Cotton Manufacturers' Association with great interest. While I doubt the possibility of successfully introducing American cotton goods into this section of Russia, on account of the keen German, Austrian and English competition, I will make an effort to investigate the market and should I discover any points which might be valuable to our manufacturers, I will promptly advise you."

Mr. S. SMITH, United States Consul at Moscow, refers to the monthly consular reports. Mr. CHRISTIAN F. Z. SCHULIN, United States Vice and Deputy Consul at Riga, writes that "The efforts indicated in the address have my fullest sympathy, but I fear that as far as Russia is concerned the prospects for an extension of the market for American cotton goods are rather hopeless, owing to the high import duties, and still more to the flourishing condition of the Russian cotton industry. At Riga alone there are three important spinning mills, not to mention numerous factories scattered throughout these western provinces and the

interior. So far, much the greater part of the raw material is, I am glad to say imported from the United States but the day may come sooner or later when the Russian cotton culture will be able to compete in the native market.

NETHERLANDS.

Mr. FRANK D. HILL, the American Consul at Amsterdam, directs attention to his recent report to the department of State on "Cotton Manufacturing in Twenthe," which is the textile manufacturing district of the Netherlands, and adds, "that any technical queries which may be propounded will receive the attention of his office which is in connection with people of technical knowledge in the district."

ITALY.

Mr. ROBERT W. BLISS, the United States Consul at Venice, reports his readiness to furnish any detailed information that may be asked of him regarding this important line.

SPAIN.

Mr. JULIUS G. LAY, United States Consul-General at Barcelona, reports his readiness to investigate the subject whenever called upon to do so. Mr. JOSEPH BOWRON, United States Consul at Carthagena, states that the great bulk of the cotton trade of Spain is done in the Barcelona district, adding, "I do not think there is any important importation of the cheaper grades of the manufactured cotton; a high protective duty, backed by intelligent work and a thorough familiarity of customers' requirements keeps out the foreign goods. In any event, in the absence of a treaty of commerce, American manufacturers would be handicapped to the extent of seven cents per kilogram as compared with the duty payable on similar goods from the leading European countries. Other things being equal if our manufacturers wish to create trade they must send expert salesmen, speaking Spanish fluently, who can exhibit samples and explain all the points — men who can quote prices deliv-

ered in the different Spanish ports and who are not above taking small sample orders. It is the same here as everywhere else — a personal interview is worth a ton of literature."

At present we have the whole trade of sheetings, jeans and drills, but no print goods; the American cottons give first class satisfaction and it would be impossible for any other nation to capture the sale of the above-mentioned articles, and since they give such satisfaction the natives will not change."

ASIA.

SYRIA.

Mr. G. BIE RAVNDAL, United States Consul at Beirut, calls attention to his commercial report of June 30, 1903 in which he devoted a considerable space to a discussion of the foreign trade in cotton fabrics in Syria, adding: "The Ottoman Empire is a consumer of cotton textiles of no small importance (the United Kingdom alone imports annually to Turkey piece goods and yarns to the amount of some twenty-five million dollars), but the United States furnishes only a comparatively very insignificant percentage, (Smyrna, for instance, takes in a year United States cotton goods worth little more than $300,000). Manchester has largely controlled this trade but has of late found a serious rival in Italy. These observations apply also to Egypt, the Sudan and other parts of north-eastern Africa, with the exception perhaps of Abyssinia."

PERSIA.

Mr. JOHN TYLER, the American Vice-Consul-General at Teheran, sent a very appreciative letter of the address and can undoubtedly be depended upon by the members of the Association to furnish all the information in his power regarding the possibilities in the direction of extending the market for cotton goods in the country.

The following interesting and suggestive letter was also received by the writer from a correspondent from Persia.

To the Editor of Dun's Review:

"Your address before the New England Cotton Manufacturers Association at Boston, has been of great interest to me; and I am very sorry that your valuable suggestions have not been acted upon by our manufacturers and merchants.

A practical application of your principles and ideas would have the advantage of extending our commerce over unappropriated areas, and giving to those already occupied a wider choice and a more diversified selection. The immensity and variety of our home field for trading operations, if they do not circumscribe the plane of vision have doubtless the effect of stereotyping the methods and means of our proceedings. Enterprise, energy, and activity require for their full growth and completion the widest limits the world can give, and the greatest ingenuity the brain of man can devise.

The time will come when our population will assume a more stationary condition and our manufactures increase out of proportion to our needs, or in other words the supply will be greater than the demand.

New regions will year by year become fewer, competition will be keener, qualities and standards will be more equal, and recommendations of superior merit or distinguished fame will be less observable to the consumer. Those who take time by the forelock and manipulate destiny by their prudence and dexterity, will have an advantage which no intellectual qualifications will overcome when the time for action has passed away.

The more advanced of the older forms of civilizations, like Persia, India, and China could, until late years, by concentrating their attention on the manufacture of a few articles of general use, supply the modest wants of their population of simple habits. But the barriers which superstition and religious seclusion had erected on the borders of the old world, preventing the encroach of strangers and their wares, are being rapidly overcome by the forces of modern ideas and improvements, until now in Persia every sensible innovation in trade and commerce is acceptable. Most countries, both ancient and modern find here a market for their productions, and also a source of supply for some of their needs.

Cotton goods are used to a greater extent in these lands of long summers and short winters than with us, inasmuch as they form a considerably larger proportion of the garments of the male population.

America has every possible facility for the manufacture of these materials, consequently should be more able than any other country to provide them better, cheaper and more attractive for the wearers. These are the highways that lead to success, and whoever can command these recommendations, will be looked upon as a benefactor to his kind, and be appreciated to the full extent of his deserts."

INDIA.

Mr. R. F. PATERSON, the United States Consul-General at Calcutta, sent the following interesting and valuable letter:

My frequent reports to the Department of State, which have been published in consular reports, have urged the importance of India as a market for our cotton goods, and that with proper efforts on the part of our manufacturers they would secure a much larger proportion of this large and valuable trade.

The imports of merchandise into India for the year ending March 31st, 1903, amounted to $252,121,306 and of this amount 35.7 per cent. was cotton goods.

Great Britain had almost 67 per cent. of the imports, and the United States only about 1.5 per cent. principally of kerosene oil, and her sales to India of the vast quantity of cotton goods consumed were practically nothing compared with the sales from Great Britain.

The importations of each class of the principal descriptions of cotton goods is shown by the following statement in millions of yards, during the year ending March 31st, 1903;

	Gray.	White.	Colored.
Shirtings,	612.43	70.75	64.89
Chadars,	497.90	52.82	55.77
Jaconets,	85.85	15.72	5.04
Mulls,	18.	81.33	1.67
Drills,	24.97	3.6	5.61
Unspecified,	.34	12.12	66.93

There are no restrictions on the importation of cotton goods from the United States that do not apply to Great Britain and all other countries, the duty being 3.5 per cent. ad valorem.

To secure this trade our manufacturers should send expert salesmen with their samples to see just what styles and colors are required to please the taste of the natives who wear only cotton goods.

British manufacturers adapt their goods to the wants of this country and are very particular in keeping up their styles and quality while our manufacturers seem to think that any goods are good enough for India, which is not the case.

The native merchants are very conservative and naturally suspicious, but once you get their confidence, there is no difficulty in holding their trade, so that our manufacturers should not only adopt the styles suited to this market, but should be careful to see that the quality of every shipment is up to the sample sold by, for when once deceived it is very difficult to regain a native merchant's confidence.

The only obstacle to the trade with the United States is the want of a direct line of steamships between New York and Calcutta, which is the principal distributing point of manufactured goods to nearly 200,000,000 of people by river and rail, whose principal clothing is cotton cloth. This, of course, rests mainly with our exporters, for when a sufficient trade is established ships will be furnished for transportation. While a line of freight steamers plies between New York and Calcutta stopping at many places, the sailings are irregular and shipments of goods via Glasgow, Liverpool, London or Naples arrive here quite as soon, though frequently delayed in transhipment.

From what I have said of this immense market for cotton goods, it would seem that there is no other market that would better pay our manufacturers to exploit than the market of India."

Mr. WILLIAM T. FEE, the American Consul at Bombay, also furnished an interesting and suggestive letter, nearly the whole of which follows:

"I am in receipt of your communication enclosing a copy of your address recently delivered before the New England Cotton Manufacturing Association in Boston. I must say that I am deeply interested in this article, and I often thought myself of the great necessity of extending our foreign market, not only for our cotton goods, but for other American productions.

There is one great trouble which you mentioned and that is, that our American exporter has not yet really got down to a serious business and is apt to neglect foreign markets and demand in favor of home markets.

England has enriched herself and her people, by her vast trade with India. She lays down weekly at this port an average of one-quarter

million pounds worth of Manchester cotton productions and when you take this into consideration with the fact that Bombay is only one port in India, and that India herself has under cultivation an average acreage of about 32,000,000 which produces about 18,000,000 bales annually, most of which is consumed in India, one realizes the vast consumption of the Indian cotton market.

Our exports to India are a mere drop in the bucket, yet if different methods were pursued there is no reason why the trade along the cotton line should not be vastly increased.

Our exporters should give up the idea of selling through our competitors and reach the market more directly through the means of our own communication and agents.

We lack in transportation; we should have skilled and well educated American agents in the field, and until this is done it is very doubtful whether we will be able to compete successfully for a very large share of the cotton trade of India."

CEYLON.

Mr. WILLIAM MONEY, the United States Consul at Colombo, wrote in part as follows: "The bulk of the cotton cloth imported to this country is consumed by very poor people who can only afford to buy cheaper goods than, I believe, are as a rule made in the United States at present. If a manufacturer desiring to obtain a large share of the market, were to send an expert here, more useful information would be obtained in a week than can be got in any other way. This market is generally overstocked with cotton goods."

STRAITS SETTLEMENTS.

The following very valuable letter was received from Mr. O. F. WILLIAMS, United States Consul-General at Singapore.

"There are many features shown in American treatment of Oriental and other markets foreign to her that invite remark. Sometimes criticism helps and sometimes it only irritates.

American cottons like certain other of our manufactures reflect a condition of trade quite unique with our own country — certain other nations manufacture mainly for foreign markets — we manufacture mainly for home trade, and send to foreign markets only a small surplus, say 4 per cent., of what we produce.

In this fact reposes much of the failure of our producers to win foreign markets. We plan to please home consumers and virtually say to foreigners that what is good enough for U. S. A. is good enough for all creation. American manufacturers are too independent, the notions of others, even if foolish must be heeded — for they are the purchasers.

Our German friends have captured a larger trade in South America and here than have we simply because they have not essayed to force their ideas of style, size, color or design upon the native mind but instead have flattered native taste by close conformity to their ideas. The same may be said of much of Oceanica — local taste is heeded and thus Germany has captured Oceanica's trade in cottons.

If we were discussing machinery, vehicles, packing, or several other incidents and features of trade we might similarly criticize American ways, but we are to-day restricted to cottons. I may conclude almost as I began that the enormous per cent. of American cotton goods being consumed by Americans having uniform taste as to weights, colors, designs, etc., make our manufactures either oblivious or arrogant as to catering to the local taste of the foreign purchaser.

The strength, durability and honesty of the cotton goods of U. S. A. are not questioned here and while I am not an authority on this question it is my opinion from observation and some study that American exports of cotton goods to this great distributing market can be multiplied in the coming decade if our manufacturers follow the plan of the studious and ambitious German and heed the local taste as to patterns, colors etc.

The American manufacturers, and I mean in all general lines, seem to regard this great distributive market of $600,000,000 (silver) trade per annum, as a sort of stop-gap or make-shift market; as a good place to turn to when other trade gets dull, and to be courted only when home trade lags. This gives local dealers an idea that America's business methods are not fixed and its merchants not responsible. Again at times they impose upon business here by shipping defective goods and goods not up to sample. This complaint has come to me several times. Only uniformity of quality, honor in filling contracts, compliance with local taste and whims, and constant attention to market wants can be expected to build up and hold trade where competitors are ever vigilant.

And finally a stereotyped complaint made by Oriental buyers of United States goods is the unwillingness of United States sellers to offer

as favorable credits, discounts and favors as are usually given by European sellers in this market. But this criticism is hackneyed — every report echoes it.

SIAM.

Mr. PAUL NASH our Consul-General at Bangkok cordially acknowledged the address and a good report may be expected from him when called for through the proper official channels.

EASTERN SIBERIA.

Mr. RICHARD Y. GREENER, United States Commercial Agent at Vladivostok wrote in part as follows: "I have to acknowledge the receipt of your interesting letter and able and suggestive pamphlet on the subject of cotton. My own experience, as a representative of the commercial interests of the United States in a foreign country, has demonstrated the truth of all you have so forcibly said. Personally, I am keenly aware of the imperfect character of the few reports I am able to make, on matters too often only properly capable of adequate treatment by an expert. I certainly, from a brief experience, heartily favor the idea you have put forth, that investigations should be conducted by "experienced representatives." There is much talk, complacent and otherwise, of pushing American goods in foreign markets; but except in certain large industries there is more talk, than real acting in such matters. A consular officer may be watchful, painstaking, industrious and conscientious in the performance of his multifarious duties; but it is very clear that even the best equipped cannot have special knowledge on the many subjects presented to his attention.

FRENCH INDO-CHINA.

Mr. I. SCHNEEGANS, the United States Commercial Agent at Saigon wrote that no outlet in that colony for American cotton goods seemed likely owing to the fact that the French general customs tariff is in force and import duties on such goods are almost prohibitive.

AFRICA.

SOUTH AFRICA.

Mr. W. H. BIGHAM, United States Consul-General at Cape Town, sent the following interesting and suggestive letter:

"I received your letter also a pamphlet containing a copy of your address delivered before the New England Cotton Manufacturers Association at Boston, which I have read with great interest. I notice on page 6 that you advocate sending trained salesmen who understand the practical details of the business to represent manufacturers in countries abroad. I think this is a point which you cannot put too much emphasis on. No manufacturer in the United States would attempt to introduce his goods in some other locality in the states by any other method than to send his intelligent traveling representative. If that is necessary in the home trade it is evident to the thinking man that it is much more necessary in the foreign trade. The handling of American goods by the British merchant here conflicts with his patriotism, and it is a thing that he would not do unless it was more profitable to him than to handle the British manufactured goods. This being the case it does not look reasonable that he would make any special effort to push these goods and increase their sale to the extent that he would if they were manufactured in the British empire. The travelling salesman in the United States is the most intelligent, persistent worker and will do more business than any other salesman on earth. This being the case it is very evident that our trade could be vastly extended if this country was worked by that kind of representatives. By all means this should be done and the goods should be kept in stock here so that orders will not have to wait to be shipped from the United States, when they could be taken from a stock of goods here and the order filled immediately.

There is another important matter that our manufacturers should attend to at once. Our decimal system of money is so simple that any merchant can figure the discount and easily arrive at the cost of his goods from list quotations, but let the merchant sit down and undertake to figure his numerous discounts off this same list quoted in sterling money; for instance, let him undertake to figure 40 per cent., 10 per cent. and 5 per cent. off the list price of some article and then an extra 2 per cent. off for cash in 60 days and have this article listed in sterling money; he will find he has quite a problem to figure out before he can

get the cost of this article. One merchant said to me I have thrown many letters into my waste basket because the goods were quoted with so many discounts to figure off; he sai l I don't want to work out a puzzle every time I undertake to find the cost of an article that I desire to buy. These merchants are not used to this manner of quoting prices, and I presume in many cases it prevents the sale of goods that would otherwise have been purchased, simply because percentage is not so easily figured in sterling money as it is in our decimal system."

MADAGASCAR.

Mr. WILLIAM H. HUNT, United States Consul at Tamatave, wrote as follows: "I received a few days ago the copy of your address delivered before the New England Cotton Manufacturer's Association which I read with interest. Much as I should like to co-operate in your endeavors to stimulate the cotton trade by some information which would prove useful I am afraid there is very little at present to relate from this country of an encouraging tone. I notice in the address your reference to Madagascar which shows that you are perfectly well informed on the situation. For many years America had almost the whole of the cotton trade of Madagascar, and the most exhaustive report on the subject, by Consul ROBINSON, is to be found in Vol. IV., No. 12, page 140 of the Consular Reports dated 1881, when the trade was in the hey-dey of its existence, and the total amount of American exports to the port of Tamatave alone reached $550,311, which with the exception of $1,500 consisted wholly of domestic sheetings and shirtings. Seven United States vessels of an aggregate tonnage of 3,664 entered Tamatavé during that year, bringing full cargoes of United States goods, and two called here during the same year to take in cargoes of native produce. This state of things with some fluctuations maintained its level up to 1898 when the trade with America stood at $556,000; but in 1899 fell suddenly to $13,000; in fact was killed by the prohibitive duties. These figures fell as low as $6,000 and $9,000 for 1900 and 1901, and only rose in 1902 to $52,000, represented by timber, petroleum

and metal articles, but not a piece of cotton goods, and those were brought in foreign bottoms, for there has not been a single United States vessel in Tamative for the last five years.

For many years strenuous efforts had been made to imitate the peculiar kind of sheetings made in America, but they were detected and the natives preferred the American article; but after the French took possession our trade was killed by tariff legislation, and adopting wholesale the American marks of the Massachusetts mills. Thus for 1902 the value of the imports into Madagascar of cotton goods alone, not including other woven fabrics was: from France and her colonies $2,000,199; from England and her colonies $31,315, from Germany $3,050; from the coast of Africa $9,142; from America $1 (one dollar) and from other countries not classified $14,339. It is true that some of the German imports were actually Massachusetts cottons, but even if they had all been such, the figures are none the less of a funereal aspect as regards American trade which is not at all likely to recapture the market in that commodity."

ZANZIBAR.

Mr. MASON MITCHELL, the American Consul writes: "I am glad to be able to report that American cotton sheeting (Americano), shipped to this port for distribution in East Africa showed an increase in 1902 over the year previous, and 1903 bids fair, at present writing, to show no falling off from 1902. The actual figures for the three years are:

1901.	Bales imported	from	U. S.	A.,		6,922
1902.	"	"	"	"		8,716
1903.	"	"	"	"	to Sept.,	5,937

We are also opening up a good market into Abyssinia via Dejibouti, one American firm shipping as high as from 1,200 to 1,500 bales per month into that market."

MOZAMBIQUE, PORTUGUESE S. E. AFRICA.

The most extended report, and owing to the dearth of previous reliable information on this subject, the most valuable was

that from Mr. W. STANLEY HOLLIS the American Consul at Lourenço Marquez. The portion of Mr. HOLLIS' able letter that relates to cotton goods here follows in full.

With regard to statistical information I beg to say that the statistics issued by the Mozambique customs administration have always been most meagre, and nothing can be extracted from them that would be of practical interest to the American cotton manufacturers. It may be noted in passing, however, that the total trade of the district, imports and exports, aggregated $19,579,081 in 1902 and $9,389,927 for the first four months of 1903, the trade with the United States alone aggregating some two million dollars.

The trade in cotton goods on this coast is a most complicated one, and the men who are doing the most business in these lines have acquired their knowledge of the trade through a long, and often costly, experience. This knowledge is, of course, very valuable to them and, not being out here on philanthropic missions, they are not giving anything valuable away.

The heaviest class of cotton goods imported into this country is canvas, or duck, of standard sizes, in small quantities, and is used for making sails, wagon covers, tents, and for tarpaulins for covering merchandise stacked in the open and merchandise shipped in open freight cars, which constitute the greater part of the railway freight rolling stock in this country. The only other canvas seen here is a brown English article; but it is not as well liked as the American canvas. A limited quantity of bleached finely woven white drills is imported here from England, and also from India, and is principally used for making clothes, coats and trousers, for white people. But as the white population in this Province is very small there is no very great demand for this class of goods.

It must also be remembered that Indian and Arab merchants have been established in this Province for hundreds of years, and that there is a considerable commerce between India and South East Africa. Many of the large Indian merchants own sailing dhows which come and go across the Indian Ocean

with the monsoons, and, as freight charges by these dhows are very small indeed, goods from India can be landed here at C. I. F. prices but a very little advanced over Bombay prices.

For these reasons a great deal of the cotton goods sold in this Province (including fine white drills just mentioned) are imported from India.

Light weight gray and white shirtings are imported in large quantities from India; and the English goods of the same quality cannot compete with these cottons of Indian manufacture. English gray sheetings, however, in pairs weighing from ⅝ to 1¼ pounds and measuring per single piece, from 29 × 40 inches, to 48 × 52 inches, are in considerable demand, and can be sold here at a profit.

Cotton blankets, woven from a coarse, fluffy yarn, and from ¾ to 4 pounds in weight, and measuring from 48 × 60 to 75 × 100 inches, in whites, half whites, grays and scarlets, and with colored stripes (blues and reds) either running across each end, or running across the whole blanket, parallel to the end stripes, are very much in demand.

These blankets are imported in single pieces, never in pairs, and each blanket is hemmed and has a sort of an over and over lock or whip stitching in red yarn around all the edges. They are mostly imported from Belgium, and are for the native trade. They are packed in bales holding from 100 to 250 blankets, according to weight. The trade at this port in these cotton blankets will amount to about 2,500 bales per year.

Another cloth very much in demand for the native trade here is the blue lopas. This is a medium texture cotton cloth, made in England and dyed a fast indigo. It very much resembles blue dungaree, only it is lighter in texture, and is woven of finer and softer yarn. It comes in pieces 27 inches wide and 21 yards long, weighing 1½ kilos or $3\frac{1}{10}$ pounds each, and packed in bales of 50 pieces. They are principally worn by native women and are used by them in making mourning clothes. The total yearly trade here in English blue lopas will be about 300 to 400 bales.

From India considerable quantities of inferior blue lopas cloths are imported, but these are of much lighter weight than the English goods; the dye is not so fast and they are very heavily sized to make them appear heavier than they really are. They are sold mostly to the poorer and less civilized natives of the interior, amongst whose villages are many little Indian trading shops.

Colored woven cottons, that is, those woven from different colored yarns, are very much in demand amongst the natives. Handkerchiefs or lencos, are largely sold.

These measure 28×26 inches and come in complete pieces containing one dozen lencos. They are of all colors imaginable, some resembling plaids, but the background colors are generally dark red or blue. They are packed 250 dozen in a bale, and the trade here is about 3,000 bales per year.

Striped salamporres are another variety of woven colored goods of medium weight. The grounds are generally blue or black and the stripes running across the cloth, from edge to edge, are about a quarter of an inch wide (though sometimes a little wider and of variable widths, first a ¼ inch stripe and next to it one a little wider) and generally of red, green and yellow.

These cloths come in pieces from 21 to 24 yards long, and in widths as follows: 32, 36, 48 and 51 inches. The trade here is about 3,000 bales, of from 200 to 250 pieces per year. These woven striped goods come mostly from the continent of Europe, the best qualities coming from Switzerland.

Some very attractive goods in this line comes from Holland, but their colors soon fade while the colors of the Swiss goods remain bright. The reason given for this is, that some peculiarity of the waters of Switzerland, possibly the presence of chalk, acts as a fixing agent on the yarns that are dyed in Switzerland for the Swiss mills. Plain, and likewise twilled, bright Turkey red cloths, 18½ inches wide and 24 yards long, and that come in bales of 500 pieces, are imported from England. These cloths are woven from a fine yarn and weigh 530 grams or 1⅛ pounds per piece. They apparently contain no

sizing, being soft and silky to the touch. In Mozambique I have seen similar cloths but dyed a bright green instead of red. A vast number of the native East Africans are Mahometans and red and green are their favorite colors.

The market for printed cotton goods here is the most erratic of all, and an expert in the trade would be obliged to devote to it a long article in order to give any detailed statement of this trade.

The colors most generally preferred are blues and blacks, in large patterns, but the tastes of the natives are most capricious. It is a common occurence for an experienced importer to become convinced that he has got a new pattern or design that will prove a good seller. He orders a shipment and it sells well. The next shipment he can hardly get rid of and loses money on it. The manufacturer who went to considerable expense to prepare new plates or stones, loses money also.

You are probably aware that considerable quantities of cotton goods are produced in Portugal and these cotton goods enjoy a preference in the Mozambique custom houses, being taxed only ten per cent. of what similar goods coming from non-Portuguese ports are taxed. In consequence of this many small Portuguese general traders here are constantly importing small lots of from five to ten bales of these Portuguese cotton goods, mostly lencos, and in which the prevailing colors are maroons and yellows.

Such, briefly stated, is the condition of the cotton goods trade in Lourenco Marquez (which also supplies the Gazaland markets); and in the balance of the Province the conditions of this trade are very much similar. The consumption of cotton goods in the remaining parts of this Province will probably amount to from four to six times what it is here.

In many instances in this report I have given the estimated number of bales that will be sold this present year, and these estimates can be relied upon to be very conservative.

So you see that, taken as a whole, this Province offers a fairly attractive market for certain lines of cotton goods; and the

question now arises, what share in the trade of this market can the United States mills get?

In some lines of rough and plain goods England cannot compete with India. What our southern mills can do in these lines remains to be demonstrated.

In colored woven cottons, if we can make similar goods, and with perfectly fast colors, we might get some of the trade. The trade in cotton blankets is certainly worth trying for. In the market for printed cottons there may be many undeveloped possibilities. There may be many surplus stocks in the United States that have gone off in the popular fancy that would find sale here.

But before any American cotton goods of any description can be sold here, samples with prices C. I. F. (don't forget the C. I. F., for if you will not take the time and trouble to get freight and insurance rates from the United States ports of Pensacola and of New York to this port, and quote a price to the Lourenço Marquez importer that will cover the cost and charges on the goods from the time they leave the factory to the time they are landed on the Lourenço Marquez docks, the importer here is not going to take the time and trouble, often with insufficient data, to figure these things out for himself) must be submitted.

In an experience of between 14 and 15 years in the United States Consular Service, I can recall but one instance of samples of American cotton goods being sent to any of the consular offices with which I have been connected, and this was at Cape Town some 14 or 15 years ago, and in this instance the prices could not compete with those of the English manufacturers.

Now cotton goods cannot be sold here without first submitting samples and C. I. F. prices. Furthermore, if samples are sent to this port by freight or by express, the landing and dock charges on even small parcels will amount to anywhere from $2.50 to $5.00 and no importer here wants to be obliged to pay out any such sums on account of small parcels of samples. If any of your friends and clients wish to submit samples and

prices, C. I. F., to the merchants of this port I would suggest that they write to this consulate submitting full particulars, as to measurements, weights, prices, etc., number of months that drafts accompanying bills of lading will be drawn for, and whether bankers will be instructed to surrender documents on acceptance of drafts.

The samples must be done up in parcels weighing not more than eleven pounds; they must be addressed to this Consulate and marked, in large letters, "AMOSTRAS SAMPLES." They must be sent by express to London or Liverpool and from thence forwarded to this place by parcel post. An arrangement for such forwarding can probably be made with any express company that carries goods between the United States and England. Samples arriving here by parcel post will be delivered to this consulate free of all charges. Samples sent here by express or freight must lie where they are landed and afterwards go into the King's warehouse, unless the senders care to send me a certified check on any eastern bank in the United States for not less than $5.00, to cover the charges hereinbefore mentioned.

For my part I will, as my consular duties permit me, take great pains to bring the samples and prices before the notice of the most responsible local importers of cotton goods.

MADEIRA ISLANDS.

Mr. T. C. JONES, the American Consul at Funchal, writes: "I find American cotton here in every shop but it all comes from London. No line of steamers comes or touches at this port from America. So London gets a slice out of all American goods coming here."

CANARY ISLANDS.

Mr. SOLOMON BERLINER, the American Consul at Teneriffe, Canary Islands writes as follows: "

"The Canary Islands are only a very small part of the world, but the trade done here ought to be looked after, especially by American exporters. The importation of cottons, from what I can gather, amounts roughly speaking, to $400,000 per year, of which American made goods are about 18 per cent. this could be largely increased, but not a single yard comes direct, but via England, and also sold by English merchants.

In every report that I have written, I have agitated the establishment of direct communication between these Islands and the United States, also that intelligent representatives be sent out to study the methods of business prevailing here. Another drawback is our banking facilities, but this could be easily remedied. In closing, I wish to draw your attention to the fact that the Canary Islands are free ports, no duties or tax of any kind are levied on cottons.

ST. HELENA.

Mr. ROBERT P. POOLEY, the American Consul in this little colony stated that as the population is less than 4,000 the demand for cotton goods there is at best small and is now entirely supplied from London. American cotton goods would, he adds, find a market there if importers could have them direct from an American port, but as it is everything comes via London and is subjected to two freights in consequence.

NORTH AMERICA AND THE WEST INDIES.

MEXICO.

Mr. ANDREW D. BARLOW, United States Consul-General at the City of Mexico wrote directing attention to his recent report on the cotton industry of Mexico which had then but just been completed.

Mr. PHILIP C. HANNA, our Consul-general at Monterey, wrote in part as follows: "I have noticed quite a substantial increase in the sales of American cotton goods in this part of Mexico during the last two years, specially those of the cheaper class·

Heretofore, Germany appeared to furnish goods which gave better satisfaction in this market than the goods manufactured in the United States, and our people are learning that if they wish to build up a foreign market, they must make their goods in harmony with the taste of the people to whom they wish to sell. For that reason and on account of the nearness of the United States to this market, there is a substantial increase in the sales of American goods."

Mr. W. W. MILLS, United States Consul at Chihuahua, writes: "While there are a large number of textile manufactories in this Republic there is still a great field for American cotton goods. Manufacturers should send good men into this field who know the language and the business methods of the people. Others cannot make a success and would better remain at home."

Mr. LOUIS KAISER, United States Consul at Mazatlán, writes "that great opportunities exist for American manufacturers in that district and he will undoubtedly place at the disposal of the members of the Association all the information they may require regarding that market." In a recent article written for Dun's Review by Mr. KAISER much interesting information was given about business methods and opportunities on the hitherto little known west coast of Mexico.

MARTINIQUE, W. I.

Mr. JACQUES D. SCHNEGG, American Vice-Consul at Martinique writes:

"Owing to prohibitive duties, the only American cotton goods imported here in very small quantities are unbleached drill, cotton sail duck and khaki. The duties are the same as applied in France on American goods, and there is besides a local duty ranging from 0.016 to 0.026 franc per meter. As agent for the American Trading Company who have here a retail store for the sale of all kinds of American manufactured goods, I have made special studies on the importation of American cotton goods, but have found that the above-mentioned goods are the only ones that can be introduced notwithstanding the high duties. To give you an idea of the charges which are very small outside of

duties, a yard of unbleached drill costing 6¼ cent per yard in the States, cost here 56 centimes a meter, and these are the goods that pay the least duties, say 80 francs per 100 kilos. Bleached drills pay 26 per cent. more duty than the unbleached article, and duties according to weight are as much as 806 francs per 100 kilos, on unbleached goods, with corresponding advance on bleached goods. Colored and printed goods pay higher duties still, and I did not dare to order any outside of khaki. As long as such duties are enforced, there will not be any opening for American cotton goods in Martinique."

BERMUDA.

Mr. W. MAXWELL GREENE, the American Consul at Hamilton writes: "I have read your address with added interest owing to the fact I was 18 years treasurer of a cotton manufacturing company in my native state of Rhode Island. During that time I made several efforts to have our product, not of our own make exclusively, introduced into South American markets having lived in that part of the world some ten years, but could get no one to co-operate; the home trade seemed then all-sufficient.

JAMAICA AND BARBADOES.

Mr. D. H. BRIDGMAN, the United States Consul at Kingston, and Mr. DAVID F. WILBER, our Consul at Barbadoes, write referring to their recent reports published in "Commercial Relations with the United States that of the latter having been, he states, partly suggested by the paper on Foreign Markets for Cotton Goods and containing considerable data on that subject.

SOUTH AMERICA.

VENEZUELA.

Mr. G. PLUMACHER, the American Consul at Maracaibo, refers to his recent report on cotton and especially cotton planting in Venezuela, published by the Department of Commerce and Labor, adding, "There is in my opinion no better country for cotton planting than Venezuela with its rich soil and con-

genial climate. I have planted in younger years, cotton on the Mississippi River and I know of what I speak. I have here on my grounds cotton trees of 15 to 20 feet high, which I planted ten years ago. They produce abundantly every season. The staple is firm, strong and very long. Lands suitable can be had for very little outlay with perfect titles from the Government. The climate is such that white men can live and also do work. I think it is well worth looking into the affair as the world's market needs more cotton than we now produce and in some countries the worm seems to do much damage. We have none of those pests here.

OCEANICA.

NEW ZEALAND.

Mr. FRANK DILLINGHAM, the American Consul-General at Auckland, writes that he has always been of the opinion that American cotton goods could be successfully introduced into that market citing the growth of the imports of American footwear from practically nothing in 1897 to $600,000 last year. The new preferential tariff, however, imposes such heavy duties on all imports from foreign countries that it is doubtful if New Zealand will continue to be an outlet for American manufactures and Mr. DILLINGHAM directs attention to his recent voluminous report on that bill which will serve to give manufacturers a very clear idea of what the measure is and what exporters will have to contend with in the future.

TAHITI.

Mr. W. F. DOTY, the American Consul at Tahiti, after referring to the excellent transportation facilities between San Francisco and that part of the Pacific remarks that "On the completion of the Panama Canal exporters at New York will have equal advantages in that far-off market."

THIRD SESSION.

THURSDAY MORNING, APRIL 28, 1904.

The Association met in Huntington Hall, at 10 A. M., President WALMSLEY in the chair.

The PRESIDENT. Gentlemen, if you will please come to order, we will at once proceed to the business of the session.

The first paper is by Mr. EBEN C. WILLEY of North Carolina, entitled The Carding Department. In his absence the Secretary will read the paper.

THE CARDING DEPARTMENT.

EBEN C. WILLEY, Hope Mills, N. C.

The success of cotton manufacturing covers in a broad sense the ability to produce cloths of marketable quality and character at a cost which will assure a fair margin of profit on the market value of the goods produced. To do this at certain times may be an impossibility for the manufacturer owing to the prevailing conditions, but this does not affect the organization of a mill or the condition of its machinery; improvements should be made in regular order that would be noticeable in one way or another, from the beginning to end of year about any manufacturing plant, both in the character of the finished goods and value of the property.

The idea in writing this paper was to make suggestions that were pertinent to the preparation of the cotton thread in its various processes through the carding department, which is recognized to be the foundation upon which the successful manufacture of cotton yarns is dependent to a large extent.

In the blending of the several grades or lots of cotton which may be used, extreme care should be exercised if the first process is to be well done and the beginning properly made, and owing to the high cost of the raw material a moderate expense at this point to insure careful attention in the details of mixing often results in a marked saving by an improved condition of the work in the after processes. Suggestions in regard to mixing

cotton by the redrawn sample system was referred to in a former paper.*

It has been demonstrated that in cleaning cotton of its impurities a heavy feed to beater gives the best results by its centrifugal action on the cotton; the improved quality of lap which is secured on the three process lapper system is on account of the extra doublings and heavy sheet of cotton delivered to the beater on the intermediate and finisher lappers, although less beaters are used than on the old system of breakers and finisher machines.

There is no question that if the first beater opens and separates the cotton as it should, it will be easier for those following to do better and cleaner work and prepare a lap for cards in the best manner; of course the grid-bars must be set correctly and draught of fans regulated to meet the location and conditions, this requires some experimenting and an overseer who is interested and understands the value of good picking, will see to it that the above matters are attended to.

On the ordinary staple cotton it is not necessary to throw out a high per cent. of fibre in the droppings to get clean picking, as the heavier feed if beater and grid-bars are properly adjusted make this unnecessary; laps both in running weight per yard and whole weight should be even, but owing to the same being regulated by the bulk it is not possible to get all the laps of uniform weight, however, they can be gotten even enough from all style of eveners, by a proper adjustment of the levers and evener kept in good working condition on a modern machine.

Lappers should be kept in the best possible condition inside as well as outside, and the only sure way is to devote a certain amount of time each day to the purpose, 10 per cent. of the actual running time should be devoted to this work and the speed regulated accordingly or new machines furnished; if beater blades and inside of machines are not kept perfectly

* See Adjustment of Cotton Preparing and Spinning Machinery, Transactions, Volume 75, Cotton, page 214.

clean it allows an accumulation of oil and dust to form which results in the cotton collecting on the end of the beaters, thereby creating an uneven current of air which causes an irregular distribution of cotton on the cages, resulting in a lap which will be found to be heavy in the centre and with light ragged selvages; this trouble is quite common.

Regarding light versus heavy feed, some years ago it was generally supposed that a light quick running feed to beater was the best method and it was believed at that time, the cotton was opened and cleaned better in this way, but later, experiments were made on a set of machines by reducing speed of rolls and feeding heavy to beater with the result, that the carding showed an immediate change both in cleanliness and character with the same improvement in the succeeding operations. The same changes have accomplished like results many times.

The question has often been raised in regard to the injury of the fibre by too close setting of the beater to feed rolls or grid bars; if the cotton detached by beater was irregular and heavy thereby clogging space between above, there would be some foundation for this belief, but as this is not possible if the cotton is held firmly by feed rolls, it would seem worth while to demonstrate this fact by a special effort to determine the actual results.

If a lapper is producing approximately 2,500 pounds of cotton per day equipped with a two bladed beater making 1,500 revolutions per minute, and allowing 10 per cent. for stoppage, the amount of cotton delivered to cages per each stroke of beater would be about ten grains, this distributed over a width of forty inches, would pass through a small space without possible injury and allow of close setting if the stock used required it on account of its low grade.

As the quality of the card sliver determines in a large measure the appearance of the product of a mill, good judgment and careful attention to details is essential to get the results which are earnestly desired by all manufacturers.

Experience and intelligence are what is demanded at this point, expense within reason to secure this is a wise investment

and the difference might be easily saved in waste, or the better running of any single process throughout a mill.

If the cards receive the laps from the picking department prepared in the best manner and the same are properly clothed, well set up and all parts adjusted so that they will run smoothly there will be no difficulty, but if otherwise, there will be no end to the trouble which will occur; as on the grinding and setting of the cards depends the quality rather than the quantity; it can therefore be readily understood why time and patience should be given to the adjustment of same in all their details, bearing in mind at the same time that equal care must be exercised in the setting of each and every part to secure quality of sliver, as the fibres are carded at every point at which they come in contact with the wire.

What numbers of card wire should be used for the various lengths of staple and should there be a difference? While some have adopted a range of numbers to cover above cottons, is it necessary? It would seem there should not be any difference, for what the longer staples make up in length the shorter would make up in increased numbers, which increases in ratio of production in a marked degree, then why is not the finer wire more suitable in either case?

Not many years ago it was customary to clothe cards for all cottons with coarse wire or from numbers 30 to 33; a lot of cards clothed in this way were later clothed with finer wire with a great improvement in quality, at the same time an increased product was secured and the same results have been noticed wherever this change has been adopted. One thing should not be overlooked, however, if the finer wire is used it should not be set too close in the foundation, as the fibres require some clearance between the points in order that the parallelism may be secured and prevent a curling or knitting of the fibres, which will occur if points are set too close together. No doubt this is partly the reason why finer wire has not been more generally adopted, for the card clothing manufacturers set the fine wire by a standard which is too close for numbers above 34 wire, for while the points of the wire act on the fibres by separating and

throwing off the impurities by the centrifugal action of the cylinder against the top flat wire, the straightening of fibres is secured between the same. By the close examination of a card it will be noticed that the cylinder points show clear and distinct above the fibres; the top flats a tangled mass of irregular lengths of fibres and foreign matter covering the points, and doffer an intermingling of carded fibres inclined toward parallelism. Nitty carding may be caused from imperfect setting, or an overloaded card cylinder, while nits are sometimes found in the raw cotton which is the result of faulty ginning; it can also be caused by the beaters if damp cotton is used, and cotton should not be used direct from the bale for this reason even if there was no other.

The draft of the card whether short or long does not effect its product unless desired, but there is no doubt that on short staple cotton a heavy lap and long draft, if cotton is held firmly at feed rolls, enables the cards to produce a better sliver; it is not possible to break or injure the fibre at feed by the extra weight of lap, but gives the card teeth a longer time to teazle the fibres before delivery to cylinder, for the amount of cotton received by the cylinder is the same in either case and certainly cannot be injured at this point; the benefit therefore accrues from the larger body of cotton presented to the action of the card points, enabling a better separation by a slower delivery with a more uniform sliver delivered with less variation in weight, as the heavier lap is always more even in thickness owing to the cages of lappers being more evenly covered, which cannot be secured when lightly covered or lapper is producing a light weight lap.

What is the possible product of a 40″ revolving top flat card? Of course the staple, and if of the short variety the nature of same governs the matter to some extent, but when cards are perfectly adjusted it has seemed that it was an injury to the cotton to produce a moderate amount at a moderate speed, as it is just as easy to over card as it is the reverse; of course this is with the understanding that the picking is not being done on the cards, if there was not quite so much fear of over picking

and carding, better results would sometimes be obtained; the practical method to get what is required in quality of carding is by a quickly running doffer and light sliver, which is also an advantage to the following process by allowing shorter drafts to be adopted.

It does not seem superfluous to add in connection with this subject, that excellent carding has been secured from the double carding system per the following: the breaker cards without lickerins and cards arranged with draft of 150 using a 34 inch, 19 ounce lap; this in many ways does not seem reasonable, however, it was successful as proved by the general results covering a term of years. I would also add that an experiment of several months duration of a double draft and weight of lap on a finisher card demonstrated the same success in an increased breaking strength of yarn, but the latter was not adopted owing to the construction of cards, the feeding arrangement not being adapted to hold the heavy sheet of cotton.

Changes in draft on the single carding system have also been followed by increased strength of yarn, which could only be accounted for in a better separation of the fibres at feed rolls and the throwing off by cylinder of a greater per cent. of short fibres, cleaner and evener carding with a more thorough mixing of the fibres by the slower delivery, owing to the longer draft and larger bulk of cotton held at feed.

The drawing frame by its simplicity and well known features is an easily operated machine and if certain rules are carefully followed good work will result; it is very important that this branch of the carding department receive the closest attention from one who realizes the necessity of a check to any irregularity in operation, as imperfect work is easily and quickly made on this process which does not retard its operation, but does to a serious extent the succeeding machines; a moderate speed of front roll should be insisted on in order to secure a well drawn sliver and the proper parallelism of the fibres.

The most important matter in connection with the slubbing frame process is to obtain an evenly drawn sliver to be twisted into roving, and the tension; there is no machine in a carding

room which is so quickly affected by the atmospheric changes owing to the nature of the roving, which is necessarily soft twisted and cannot be wound so compactly on the bobbin, as in the other processes of roving frames, and which requires the tension to be carefully regulated; excessive twist should be avoided as a serious danger by preventing uniform and even work from the following machines.

To the evenness in drawing the sliver at this point, depends the elimination of many uneven or weak places in the yarn, as a light spot in the roving is sure to receive extra twist causing an irregular draft in the next process which no amount of doubling can wholly overcome.

Is the present arrangement of rolls and weighting on the fly frame pattern slubber equal to the inclined system and lever weighting used on the speeder or single flyer frame? From personal observation, it has always seemed that roving from the frames equipped with the latter style rolls produced a much evener and regular drawn sliver, but this was off-set to some extent by the construction of frames below the rolls, as there is not the least doubt of the superiority of the regular fly frame arrangement, with bobbin leading the flyer. The weighting of the rolls by the lever principle on this style of frame is its strong advantage, as it insures a more perfect weighting of top rolls by the combination of two saddles the same as on the spinning frame; by this method the weight is thrown onto the front and back rolls with only a slight pressure on the middle roll; this allows for a closer adjustment of front rolls with a corresponding eveness of roving; this idea might be carried out on all process of spinning machinery that puts in twist, for, if it is applicable to a spinning frame why not to a frame whose rolls are drawing a strand many times larger in bulk and weight? Nearly all back saddles for fly frames are made so that the weight on middle is the same as that on back roll. What the advantage of the inclined arrangement of rolls would accomplish as compared to the present system it would be hard to say, but there is no question regarding the practicability of the above system of weighting.

The intermediate and fly frame process is a system of repeat-

ing to double and draw the roving to a finer strand and as the quality of same is determined by the ability of the rolls to do this, even top rolls, steel rolls running without vibration and correctly spread for the length of staple is an essential matter; the only way to secure this is by a close attention to details by those who have the oversight of these machines.

Occasionally a little judicious experimenting to determine what the value of any change in adjustment would accomplish by a test in strength of yarn is a good thing; in fact the value of any experiment or change of whatever nature should be demonstrated in this way.

In regard to twist, too slack twist is nearly as serious a drawback as too much, although it does not occur as often. To cite an instance of the trouble caused by excessive twist will do to illustrate. Several years ago a mill spinning medium numbers using an excellent grade and staple cotton was running badly, particularly the warp spinning, the roving being very uneven; the fly frames in the carding room were running well, but on looking into the matter it was found that the roving from each process was excessively twisted and to overcome this, the rolls were spread about ⅛ of an inch more than was required for the length of staple used. An immediate change in twist and closing of rolls remedied the difficulty which was very noticeable both in improved spinning and strength of yarn. This also eliminated the troublesome weak threads which are always found in yarns of this character.

As conditions are never the same in any two mills, it is not possible to accomplish the same result by the same methods, but the ground work is the same in every case, and as the strength of yarn denotes eveness, quality and product, the men who hold positions of responsibility and trust about a mill should be striving at all times to secure the above conditions both as an individual and as an encouragement for others who may be employed under him. A nicely running mill usually assures a contented set of operatives which is dependent in a large measure to the quality of roving from the carding department.

Mr. WILLIAM HAYES. Mr. President, I have had much experience with the old card and the revolving flat card, and have spent almost all my life on the old fashioned cards. One day I was chatting with Mr. BATTEN, the boss carder, and he suggested the idea that tops could be cleaned in their travel. We have secured patents in London and Washington on an additional top stripper for a revolving flat card. It is simply a stripper on the crown of the cylinder.

We put a steel plate over the cylinder, sacrificing a few tops, of course, and the tops leave the cylinder and pass over the bridge right on to the crown and are stripped, so, of course, the last part of the carding is just as good as the first. The tops go on to the cylinder clean and they strike the cylinder again clean in the center. I have had one card running for about a year in my own mill, and the in stripping that I get on top the leaves are larger and there is a larger collection of dirt and sediment, the same as we get under a card on the floor. The general character of the stripping is very cheap, five times cheaper than the stripping that we get in front, showing, to my mind, the way the tops do not hold the dirt. The tops travel too long without being cleaned. Cleaning the tops as we do, right in the middle, we reduce the speed of the tops just one third. We have a 45 inch card put in about five years ago. Previous to that I had charge of the mill 21 years on the old double cards. We took off a 6 inch pulley and put on a 4 inch. We can allow the tops to stay on the cylinder one third longer, without nits or motes.

Another point is that we have demonstrated at the mill that we can put 25 per cent. more work on the card easily. For instance, I am carding 150 pounds on 35 yarn on a 45 inch card, and I can put that right up to 190 or 200, and I will get a finer sliver. The best men that I have met will back me up in the statement. There is less fine stuff and the staples are more parallel — no question about it — and up to the point where we use combers the waste of the card on medium numbers will be less. I have no doubt as far as I have tested it that the

waste from the front stripper is so white and clean that it will go back, and, therefore, the general waste of the card on medium numbers will be less and of course on finer numbers you want your combings. The Mason Machine Shop at Taunton has been testing this patent for some months, and they give me permission to say that so far as they have proceeded they are very much pleased with it. I have faith enough in it to alter my cards over, and the Mason Machine Shop has had orders to change over my cards to the Batten-Hayes patent — the top stripper on the cylinder.

The PRESIDENT. Any further discussion, gentlemen? I take it that most practical mill men are agreed that the carding department is without doubt the most important department in the whole process of cotton manufacture, in other words, the backbone of the entire process. The paper is intensely practical and valuable, and some further discussion would be certainly desirable.

Gentlemen, if there is no further discussion on this paper, we will pass to the next, which is entitled, Humidity in Cotton Manufacturing, by GEORGE A. AYER, of Easthampton, Mass. If Mr. AYER or any one else can enlighten us or give us any better results than we are getting today, I may, perhaps, be permitted to say, through the influence and assistance of the drosophore, which is practically universally in use, I am sure we shall be very glad to hear what he has to say. The question, of course, is extremely important in cotton manufacturing, and whilst the drosophore has achieved more results, and practically has achieved everything, so far as we know today, that it is possible to achieve, practically making us independent of the outside atmosphere, we are still ready to learn.

Mr. GEORGE A. AYER. When your Secretary asked me to prepare a paper on this subject I thought it was going to be

a simple and easy thing to do, and I asked him to furnish me the names and references of gentlemen who had spoken before on this subject. He sent me some twenty odd references and amongst the names were those of the late BENJAMIN DOBSON, our own honored president and secretary, and the name of the "Grand Old Man" of the cotton manufacturers, Mr. EDWARD ATKINSON, appeared several times. Now to prepare a scientific article after reading or listening to those gentlemen, I found practically impossible, so I decided to write up a few personal experiences and tell the few things that I have found in my own experience, without any attempt at a scientific argument.

*HUMIDITY IN COTTON MANUFACTURING.

GEORGE A. AYER, Easthampton, Mass.

A small boy when asked to define salt said that it was something that made potatoes taste badly when you didn't put it on, and humidity may be defined as something that makes cotton work badly when not present in suitable quantities. Now the condition of the air as regards moisture involves two elements: first, the amount of moisture in the air; second, the ratio of this to the amount which would saturate the air at the actual temperature. It is upon the second of these elements that our sensations of dryness and dampness depend and it is this element which is termed humidity or relative humidity, and is usually expressed in percentage.

COTTON.

Now most of the gentlemen present are probably well acquainted with the cotton fibre but I will venture again to describe it and do so in the language of our secretary, Mr. WOODBURY, who with his usual clearness of expression defines

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For further references on the subject of Humidity see Transactions as follows: Godfrey D. Wheelock, Vol. 5, p. 6; Edward Atkinson, Vol. 25, p. 49; C. J. H. Woodbury, Vol. 26, p. 41; J. G. Garland, Vol. 27, p. 30; William C. Lovering, Vol. 35, p. 6; Charles H. Fisher, Vol. 37, p. 7; Edward Atkinson, Vol. 47, p. 41; S. Homer Woodbridge, Vol. 47, p. 58; Edward Atkinson, Vol. 47, p. 83; F. E. Saunders, Vol. 49, p. 5; Emile H. Klaber, Vol. 49, p. 18; F. E. Sanders, Vol. 49, p. 5; Sir Benjamin A. Dobson, Vol. 57, p. 185; H. E. Walmsley, Vol. 61, p. 136; Alfred Hawkesworth, Vol. 61, p. 316; Edward Atkinson, Vol. 63, p. 225; Daniel Moore Bates, Jr., Vol. 66, p. 240; Alfred Hunting, Vol. 66, p. 261; William W. Crosby, Vol. 72, p. 141; William D. Hartshone, Vol. 73, p. 161; John Gregson, Vol. 75, p. 153.

the cotton fibre as a spirally twisted ribbon, thicker at the edges than in the middle, caused by the collapsing of a tube which was originally filled with liquid sap. These fibres adhere together by the collusion of their spirals fitting into each other, comparable to the grasp of two hands in the act of shaking hands, when the fibres are at their closest contact. Now the effect of humidity is to increase the twist of these spirals and while it diminishes the length of the individual fibre, and therefore of the whole thread if tightly twisted, if loosely twisted and under tension the fibres will slip by each other and the thread becomes longer, as in drawing.

A PROBLEM.

About twenty-five years ago the value of humidity in spinning was forcibly brought to my attention in attempting to spin medium counts, 40s to 60s on frames, the spinning room being over a thread dressing room. The principal means for humidifying at that time were the watering pot and steam pot. In the mills of the day the steam pipes, usually one inch in diameter, were placed near the floor against the walls of the mill. In some cases pet cocks were screwed into the heating pipes which when opened resulted in a great deal of heat and very little moisture. There seemed to be a general feeling that heat was very desirable in cotton working, and in many mills, especially the finer ones, the heat was intense.

In the spinning room of which I have spoken, the heat of the dressing room coming through the floor, made the room very hot and excessively dry. There was no means of moistening provided except the watering can, and a too free use of this same can was liable to bring trouble from below, in the shape of the overseer of the dressing room. His claims as to the amount of water which had dripped through the floor would have been funny had it not been a serious thing for him. Still there was no other way, and the problem of maintaining an atmosphere humid enough to do good spinning, and still avoid trouble from below, led to a careful study of humidity as effecting cotton

manufacture. At this time I made many experiments and some inventions, two of which, the power hygrometer and its application to the railway head under the name of a railway head governor were patented, (see cuts). I also made plans of a mill building, the temperature and humidity of which was to be entirely independent of atmospheric conditions, and the general scheme of which was a basement to be used as a plenum chamber with power fans to furnish air, steam coils to heat, ammonia plant to cool and sprays to humidify. All to be controlled automatically, the humidifying apparatus by the power hygrometer and the temperature by rheostat, invented but not patented, about that time.

Those of you who have had experience with the railway-head-evener, will remember that the machine was governed by the tension of the cotton passing through the trumpet, and that the drawing rolls were driven faster or slower, according to the position of the trumpet. This tension was governed by a movable weight attached to the lever arm, and under the bed of the machine. It was customary to weigh the sliver soon after starting up in the morning, then adjust the weight so as to bring the sliver to the proper weight. Repeating this operation from time to time during the day. Now at times the cotton would stand out and become fluffy and harsh, and from this cause a light sliver would exert as much pull at the trumpet's mouth as a heavier sliver at other times. I early became aware that the cause of this difference was in the percentage of humidity in the air. When the air was dry, cotton stood out and was full of electricity. When the air was humid, the cotton laid down and slipped through the trumpet's mouth easily. It was my belief that an instrument that would overcome this difference would be of value. And after a good deal of experiment, I perfected a device which would do the work. This consisted of two strips of soft pine wood about one inch square, cut across the grain, fastened to a metal base, and with a metal cap at the top, connected from top to bottom by a thin metal strip, which was also cemented to the wood. These strips of wood readily absorb

and give out moisture thereby swelling or shrinking as the case might be, and, not being able to expand on the back, bending backward when damp, and forward when dry, from the perpendicular, according to the percentage of humidity in the air, and with considerable force, could be made to pull or push a rea-

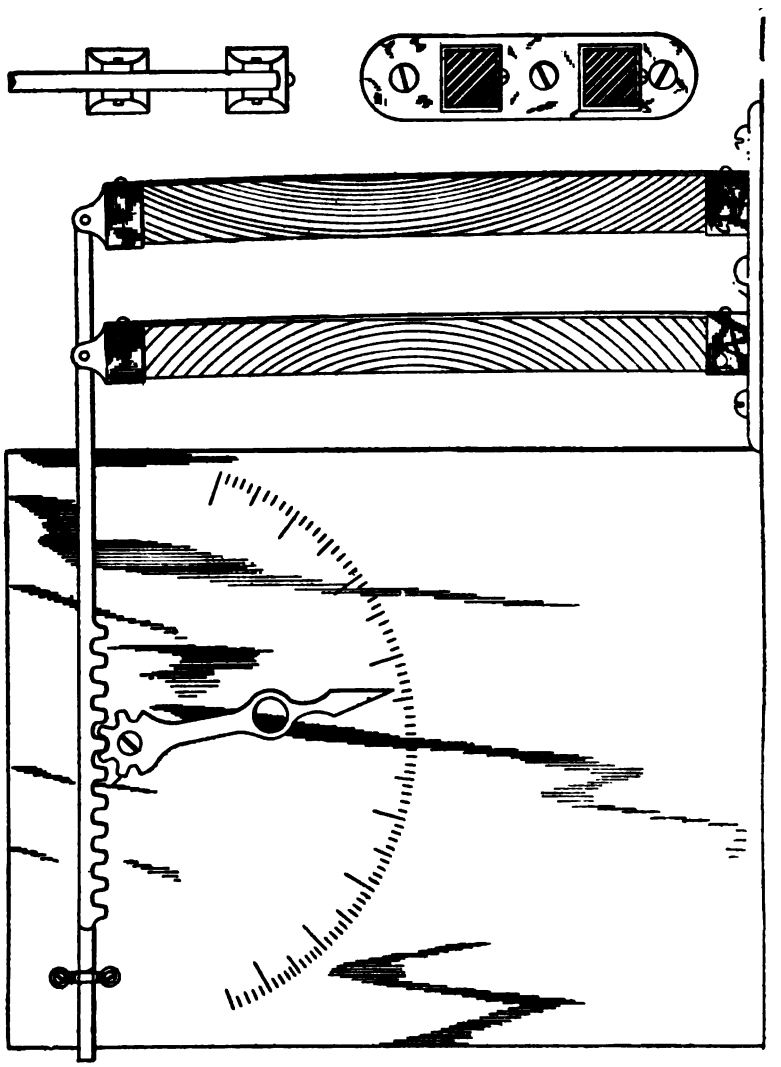

FIGURE 1. HYGROMETER.

sonable number of pounds by increasing the number of upright sticks.

After experiment and comparison with the standard hygrodeik, I attached the machine to the railway head evener, and in place of the adjustable weight, used a sliding weight.

These were used in several mills at the time with considerable success, and the machines ran for weeks together, after being properly adjusted, without change, producing sliver the weight of which was not effected by the change of humidity from day to day.

Applications for patents were made, both as a hygrometer, capable of exerting dynamic force, and as a hygromatic railway

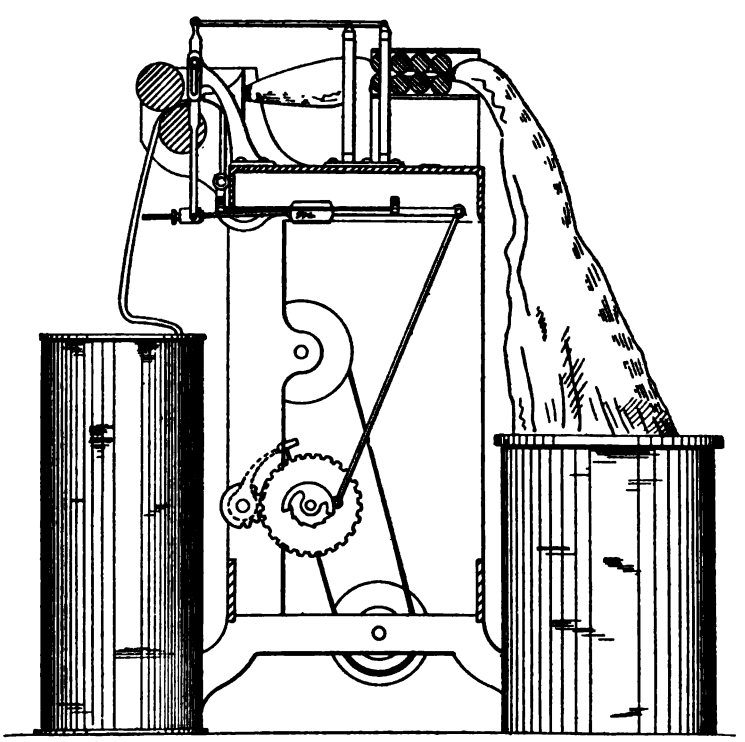

FIGURE 2. HYGROMETER APPLIED TO RAILWAY HEAD. SIDE ELEVATION.

governor. On both of which I obtained what were known as "bottom patents," they being the first of their kind issued in the United States Patent Office.

TEMPERATURE.

Air at 60 degrees Fahrenheit is capable of carrying 5.7 grains of moisture per cubic foot at saturation. Increase the temperature to 100 degrees without increasing the moisture and the hygrometer would show 29 per cent. and it would require 19.8 grains per cubic foot for complete saturation or dew point. Air at a low temperature requires much less moisture to reach a

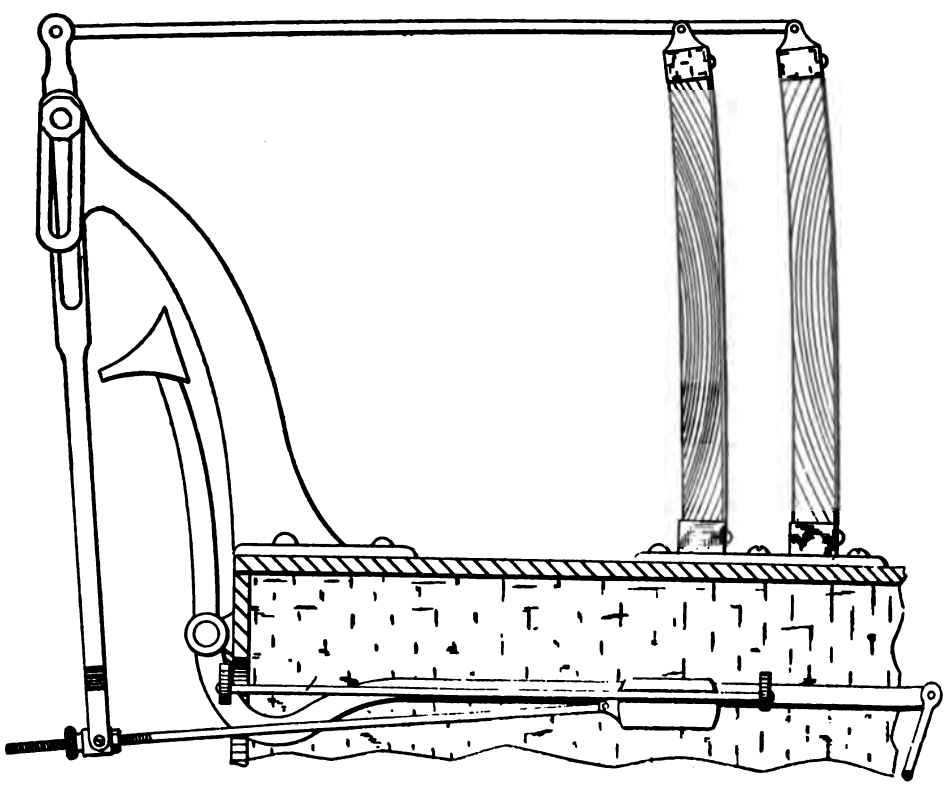

FIGURE 3. HYGROMETER AS APPLIED. SHOWING TRUMPET AND SLIDING WEIGHT.

given percentage, necessary for good spinning, than at the higher temperature. My experience leads me to believe that temperature, within a reasonable range, has little to do with the cotton working except as it effects lubrication and personal comfort. There is in all rooms a constant circulation of air. One end or side of the room is warmer than the other, usually the south side. In this case the warm air rises to the top of the room and flows to the north side, where it comes in contact with the windows and walls, cools, and then drops to the floor and flows back to the south side. As a rule in all departments work runs better on the north than on the south side of the mill.

In my opinion ventilation or plenty of good wholesome air is a great factor in the quality and quantity of the mill's product. A man can live a month without food, possibly a week without water but a very few minutes without air, and the vital principal of air is oxygen. Oxygen then is a necessity, and other conditions being equal, a man or woman in a well ventilated room will produce a greater per cent. of good quality work than in an over-heated and ill-ventilated room.

ELECTRICITY.

Dry air and electricity go hand in hand. One is seldom present without the other. The effect of dry air and electricity on the cotton fibre is exactly the reverse of moisture. The fibres seem to repel each other and in the spinning the result is the production of a rough, hairy thread, deficient in strength and very undesirable, especially in warp. Even if the yarn be well spun, under proper conditions, and afterwards exposed to dry air charged with electricity, it will become hairy and weak. It may be safely laid down as a rule that the amount of electricity in the air is in inverse proportion to the humidity and it is essential to the quality of the work that every department be properly humidified.

A well spun warp can be sized almost to harshness, and in a room where the humidity is at 75 per cent. it will become strong and tough, showing a minimum of breakage. There will be no

soft warps in the mill where the warps are properly sized and the humidity what it should be. There are, however, some exceptions to this rule. When the mill is new and the belting stiff and dry, or in the case of slipping belts, electricity may be generated in a manner difficult to do away with. But I have been successful in taking up the electricity by copper wires hung nearly in contact with the belts and attached to the sprinkler, or other piping of the mill, until such a time as the trouble can be remedied, as it usually can be by properly oiling belts.

THE IDEAL MILL.

Much has been written in regards to favored localities for the manufacture of cotton fabrics, and some places have been especially designated on account of the condition of humidity. I believe that the mill of the future will be built so that the conditions as regards temperature and humidity, will be entirely independent of outside influence and this strictly from an economic stand-point. The nearest I have ever been able to approach these conditions was in a print cloth mill of 50,000 spindles. This mill was originally equipped with an aerophor system supplemented by steam pipes into which pet cocks had been screwed. The aerophor system had gone to decay. The bare steam pipes produced more heat than moisture and the natural result was low production and high costs. There was a basement the full size of the mill building in which water stood a great portion of the time, and the excessive dampness had attacked the timbers and floor in a threatening manner. In all other respects the mill was first class and up to date.

The problem presented was to save the floor and floor timbers and furnish humidity sufficient for successful manufacturing. There were few windows in the basement and these were made tight. A fan was installed and the basement was used as a plenum chamber. This fan was at one end of the mill and directly in front of the fan opening, a trench, which always contained water, was dug, extending the full length of the mill. Galvanized iron pipes were erected from the basement to the

various rooms. These pipes were placed directly beside the posts and were nearly all 10 inches in diameter.

There were 7 pipes for the carding-room; 28 for the spinning room and 82 for the weave room. In addition to the moisture which could be gathered by the air in the basement, and for use in extremely dry weather, there was installed a series of steam pipes running lengthwise of the basement and beside the piers. Under each of the upright pipes was extended a branch from the main. This branch was of brass to prevent corroding and directly under the opening of the pipe were cut three slots crosswise in the pipe and pointing upwards into the air pipe. These slots were very narrow and cut with a common hack saw ground to the thickness of $\frac{1}{100}$ of an inch.

A valve at the end of the mill led up into each of the rooms so that the overseer could at any moment open or close them, thereby increasing or decreasing the amount of wet steam that he cared to admit into the moistening pipes. All the steam pipes were carefully covered, and the effect of the jets of steam into the air tubes, with the air under pressure and running upwards, was to so thoroughly assimilate the moisture that the odor of steam could not be detected at the top of the pipe; and the feeling to the hand was as of cold damp air rushing out with the appearance of a fog and immediately disappearing.

There were placed in each room six hygrometers and six thermometers, these being arranged on the outside rows of posts, two near each end of the room and two near the center. Orders were given to keep the card room at a humidity as nearly as practicable 50 per cent., the spinning at 60 per cent., and the weaving 70 to 75 per cent. To be sure that this was properly done, reports to the superintendent were arranged to be taken at 7 A. M. and 1.30 P. M. In dry weather it was found well to open the moistening valves at six in the morning that the rooms might be at the proper humidity at 6.30 for starting. The general results of this system were very satisfactory and it has been continued to the present date with little or no change.

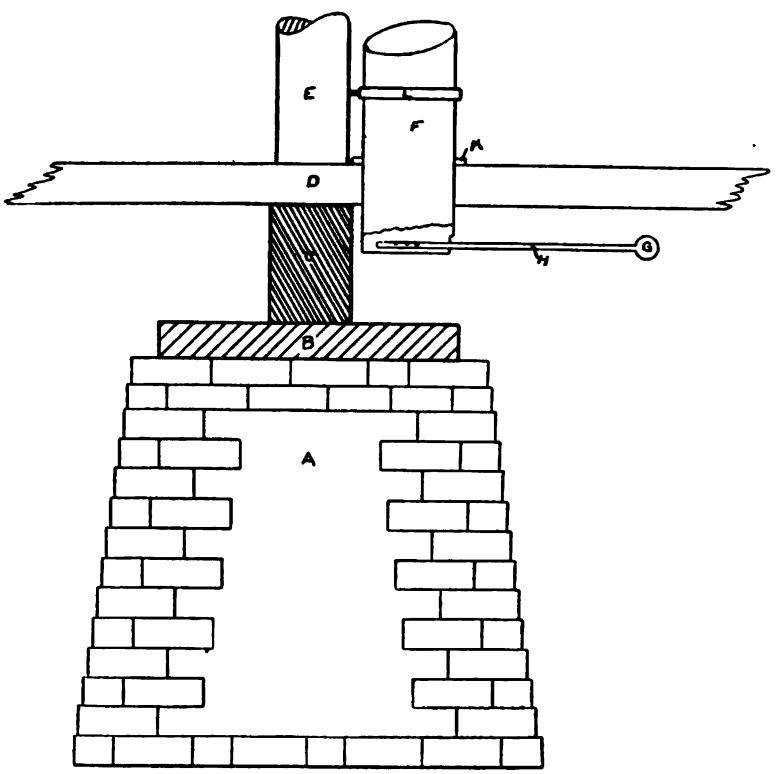

FIGURE 3. HUMIDIFIER IN BASEMENT.

A. Brick pier.
B. Cap stone.
C. Floor timber.
D. Floor.
E. Post.
F. Air pipe to room from basement.
G. Main steam pipe.
H. Small branch steam pipe running under F.
K. Collar around F to keep water from running into chamber below.
L. Support for pipe F attached to post E.

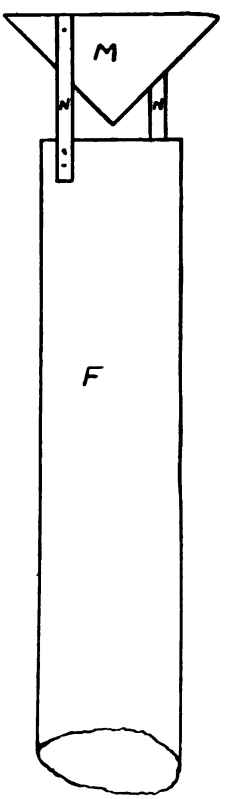

FIGURE 4. DIFFUSER OF HUMIDIFIED AIR.

F. Top of pipe coming up from basement.
M. Inverted conical cap used to deflect moist air coming through F.
N. Supports holding M in position above F.

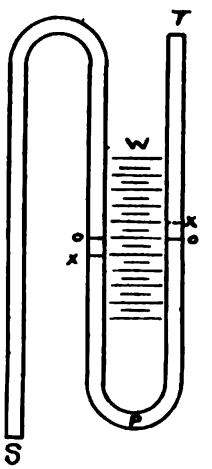

FIGURE 5. AIR PRESSURE GAUGE.

S. Open end of glass tube connected by piping with basement.
T. Upper end of glass tube covered with cloth.
P. Part of tube filled with water.
O. Height of water in tubes when fan is stopped.
X. Height of water in tubes when fan is running.
W. Reading scale between water tubes used to show difference in height of water surfaces.

The decay of the basement timbers was checked at once.

The rooms above were supplied with plenty of fresh, clean, cool air at just the degree of humidity desired most of the time, and even in dog day weather the forcing of air through the basement seemed to have a very beneficial result. In cool weather the rooms were kept at a temperature of from 65 to 70 degrees. The spinning was on frames and ran well. Previous to the installing of this system it has been the practice to moisten the filling with water. This injured the bobbins, causing them to swell and give trouble on the spindles. To remedy this trouble, and in addition to the general moistening system, there was a room boarded off in the basement at such a level that

water was constantly just under the floor. Moisture was introduced into this room in the same manner as in the other rooms, the humidity was kept at from 90 to 95 per cent. The room opened into the elevator well in such a manner that the filling could be brought directly from the spinning room in slatted trucks and kept in store from twenty four to forty eight hours: after which time the twist was found to be well set and the filling to weave without kinking, the bobbins fitting perfectly and lasting well. The production and cost of this mill for one year is appended in tabular form, trusting that it will compare favorably with other print mills. It certainly eclipsed all previous records of this mill.

I will say that the production of the weave room was figured on the basis of a loom speed of 200 picks per minute and cloth in the bale ready for shipment. The cotton used was strict good ordinary and strict low middling.

In conclusion I wish to say that it is my experience that no important factor in manufacturing is so little understood as the proper control of humidity. While much has been written on the subject, and the manufacturers of humidifying apparatus urge the necessity of its use, systems installed at large expense are frequently found in poor working condition. Instruments for determining the percentage of moisture are allowed to run dry, and become clogged with lint and dirt, with the result that they cannot show the true condition of the air. I have found that the only way I could get proper results was by daily personal observation, and by reports from the various men in charge.

My whole experience leads me to believe that the highest success in cotton manufacturing demands proper atmospheric conditions, and especially a perfect control of humidity.

PRINT CLOTH MILL. COSTS FOR ONE YEAR, FIFTY-THREE WEEKS.

Cotton	CARDING.		WARP SPIN.		Spooling and Warping.	FILLING SPIN		WEAVING.				Cloth.	Miscl.	Motive Power.	Total	Average Number.	Percent. Cloth Production.
Used	Lbs.	Cost.	Lbs.	Cost.	Cost.	Lbs.	Cost.	Pieces.	Yards.	Pounds.	Cost.	Cost.	Cost.	Cost.	Cost.		
1,036,622	829,056	0086	443,469	0093	0131	354,990	0145	109,616	5,600,715	830,893	0329	0016	0032	0009	0659	32.95	91.7
889,421	735,142	0089	339,548	0088	0122	316,040	0151	99,695	5,146,744	713,319	0332	0017	0030	0011	0670	33.80	90.3
914,181	762,962	0087	410,920	0092	0121	331,338	0141	103,661	5,302,284	776,839	0321	0016	0027	0010	0632	32.90	91.6
915,273	738,893	0087	398,050	0096	0125	310,607	0136	105,138	5,471,356	758,448	0333	0016	0029	0010	0625	33.49	94.6

The PRESIDENT. Gentlemen, it is perfectly evident that you have followed with considerable interest Mr. AYER'S thoroughly practical paper. In looking around the audience I find there are several gentlemen interested and engaged in this particular work, and, therefore, I do not think that there will be any lack of discussion, which I will call upon Mr. LYALL to open.

The SECRETARY. Mr. LYALL left the hall a few moments ago.

The PRESIDENT. Then I will call upon Mr. COMINS who represents the Drosophore system.

Mr. FRANK B. COMINS. Mr. President, I don't know that it is entirely in order for me to express anything on this subject. I understood that you called for Mr. LYALL. It is perhaps, fortunate for our friend, Mr. AYER, that he is not here, as his views on the subject might be a little shattered, as Mr. LYALL is a strong believer in the system I represent and has now with him proposals for an extension of the same. I agree with Mr. AYER in the views he is attempting to express and in the apparatus he describes. As a means of ventilating basements it is very good, and it has been used and its real value has been to the end of giving better conditions in basements, saving the timbers from decay. Beyond that you are going back with it to the old days of the vapor pot, and we cannot see where you are really assisted in its use above the methods that you have all used for forty or fifty years.

Mr. GEORGE A. AYER. The remarks of the gentleman would lead one to think, perhaps, that it was my desire to set aside the present condition or apparatus which the gentleman represents. That is a mistake. My position is that the future mill will be somewhat different from the present, inasmuch as it will be absolutely in control, day and night, and all air will be treated before it enters the rooms. I am a believer in Mr. COMINS' system of humidifying, in fact, I use it and

recommend it, but I think this is in a state of evolution and I would no more say that Mr. COMINS' had arrived at the correct solution of it than I would say that there would be no improvement in cotton manufacturing in years to come. It is simply evolutionary; his system will pass away. As directly applied, or as applied at present, his system may be used in connection with the humidifying of the rooms, but I think the time will come when his company, perhaps, will recommend other systems, or an extension of the system which they now use, or a different application of it.

Mr. FRANK B. COMINS. I wanted to say Mr. AYER, that we are really not prejudiced. Those who know me know how closely I have been investigating the matter for the last fifteen yesrs, and those associated with me have made the closest study of the subject. We have looked abroad and into every known device, and with a view of giving the manufacturers a system which will be economical and give them the results which they must necessarily have. And in all our researches, although we have found innumerable devices which here and there have given satisfactory results, we have never found anything which we felt we could honestly give our time and capital to present to the manufacturer and stand behind. We have been through this, as you know, in all its phases with our system, and the one referred to by Mr. AYER was a system put in some ten years ago or more and allowed to depreciate from the moment it went in, through some prejudices in the mill which there is no need of our going into here, and it was necessary in that instance, to find some means, crude as they might be, to get the results to which Mr. AYER refers. We have looked at that device in all lights and phases, and really we could not go to our manufacturers and present it to them as a proper system. Even though our system perhaps might be considered a little more complicated, we know from continued years of service in all classes of work and under all conditions that today it is giving better results and accomplishes more in all departments of the mill than any other known apparatus.

Mr. GEORGE A. AYER. I do not think I can find any fault with Mr. COMINS' remarks. I will simply say that each manufacturing plant is in itself a problem. This method of humidifying was adapted to this especial plant. If I were building a plant today I should not build a plant like it. It was simply a condition, not a theory, and we had to meet the conditions, but the results were very gratifying.

The PRESIDENT. Gentlemen, I have just been notified that a non-member desired to discuss the paper just read, and if there is no objection I will call upon him. There is evidently no objection. Mr. WESTON.

Mr. FRANK W. WESTON. Mr. President and gentlemen. The matter of humidity in cotton mills and in all textile works is something in which I am deeply interested, but I cannot approach the discussion of the matter from the technical standpoint of the cotton manufacturer. The point with me is the present method by which you establish humid conditions in your place of work the best method that can be devised, or is it, as Mr. AYER says, a transitory stage, a beginning of something, — acknowledgedly superior to any thing which has preceded it, but probably inferior to that which will eventually supersede it? My opinion is that it will. The very able remarks of Mr. COMINS I have listened to with considerable interest and I admire his standpoint, but I am very sure that before many of the gentlemen who are here today have passed away a system will be introducted to them, or, rather, to put it in other words, a system will be adopted by them which will be as infinitely superior to any atomizing or any other system in which minute particles of water have a place as the present drosophore system is to the old deg-can, and that, we know, was a very admirable thing in some particulars. You all know, gentlemen, how Sir BENJAMIN DOBSON tried to find a means by which some slow process of evaporation should permeate the atmosphere with moisture to the extent which your processes re-

quired without any danger of precipitation from any cause whatever. Sir BENJAMIN DOBSON says in his writings that he looked to nature for his inspiration. Doubtless he considered the work of the Gulf Stream. And the Gulf Stream, as you all know, which somewhere off these coasts joins the stream of the Antilles and flows across the Atlantic with a constantly increasing width and a constantly decreasing depth until it is lost against the shores of northern Europe, including the coasts of Great Britain — that stream as it flows across is acted upon by the atmosphere, and every molecule of air which touches those warmed waters becomes impregnated with the moisture of that water, assumes the temperature of that water, and collectively departs upon its mission, whether it is to be condensed later in rain to fall upon the parched fields of Europe, or whether it is to permeate the atmosphere which makes it possible to spin the finest cotton in the world in the mills at Bolton. Now some method by which the process which nature has dictated to us will undoubtedly supplant any process which means the utilization of small atoms of water. And, not to detain you too long and to bring the whole thing into a nutshell, there is such a process already. It has not been, perhaps, exploited yet to any great extent, but there is an instrument by which the air of a mill room shall be impregnated with moisture to any extent you desire, not to any accidental proportionate extent, but to positive extent, whether it is of relative humidity or of positive humidity. That is to say, your atmosphere shall have in its composition either so many grains of water to a cubic foot, or it shall have a relative percentage of humidity according to its temperature, or either as you will. Further than that, this instrument which I refer to will produce not only the grains of water or the relative humidity which you may require, but it will give you the atmosphere which you may require. It will positively establish and maintain in your spinning rooms, in your weaving shops, any degree of temperature that you may require. If you have been suffering from too much heat you can with this instrument bring it down to wherever you please.

That is a result which no instrument yet before the textile community has ever achieved.

Mr. AYER spoke of the cotton mills of the future. I quite agree with him, and I agree with him from my own professional standpoint, for I am an architect, and it is as an architect that I approached this subject first. My first endeavor was to find a means by which I could establish and maintain temperature in auditoriums, places where large assemblies of people congregate, and from that I pursued the matter until I became interested in this branch of it. But I will go a little further than Mr. AYER; I will say that the mill of the future, in my opinion, is a building which shall be so completely insulated that outside temperature will have no effect whatever upon the interior of that mill; that its walls shall be thoroughly protected, its windows shall be for light only, double or triple sashes as the case may be, and condensation from the exterior cold shall be an impossibility. The air of that mill will be its own; that is to say, the exterior air will be kept out of that mill in every possible way, because the instrument which I refer to, gentlemen, is an instrument which will purify that air, will keep it pure as well as keep it in any condition of relative humidity or of temperature that you may require.

Now these are very large statements and I can only say in conclusion that the name of the instrument which I refer to is the Regenerator, which is a comparatively new instrument, which is established here in Boston, which works upon these lines and the lines which nature has dictated to us, and which, I believe, is going to supplant all known systems of humidification as easily as it will supply to the waiting world the means of controlling temperature, for no such means at present exist. The Regenerator can be seen in Boston in operation; it is already in operation in some of the mills, but the actual operation can be seen here at arm's length. You can go to the office and have a demonstration of its workings, of the results which it will achieve, and you will have explained to you by full sized working drawings its entire composition. There is no box of tricks about it;

there is nothing secret. The whole thing can be explained to you, and you can sit in a room where the temperature when you enter will be 105 degrees and in a few minutes you will be enjoying the temperatere of about 68 degrees. That, gentlemen, is about all that I can say on the subject, except that if there are any specific questions which I can reply to I shall be very glad.

Mr. FRANK B. COMINS. Mr. President, I feel as a brother manufacturer and member of this Association that, knowing what I do of this machine that has been referred to, having seen that demonstration at the office as well as the machine in the mill, it is due to me to say a little further to enlighten you on its features. It is presented to you here as a new apparatus — only theoretically so, as it is presented. Its mechanism almost literally is the same as the apparatus I first had to contend with, and which it was introduced in this country in about the year 1888. And it was through the complications of that machine, its detail and expense to maintain, that it was discarded just as I took hold of the business. Although it would give equally as good results as any apparatus, now, either as represented by us or presented to you elsewhere, it was so complicated and cost so much to maintain and needed so much, almost daily attention here and there through the mill, that we stopped it at once and I do not think there are any out; I think they have all been discarded, although it was interesting to watch in the few instances from year to year where they cared for them and to see that they were doing the work. But they are all out now. The regenerated air machine in design, excepting in some little internal arrangements, is practically the same as we used years ago. It has a water motor or an electric motor, and a fan and jets of water and some further complications that we did not have, but all that we had and nothing else that I can see other than theoretically, nothing for mill use. I can imagine that in some places it might be operated and not develop the detrimental effects that you would find in mill work, which is

very different from any other line of work, as you all know. I would be pleased if there is anybody here that is especially interested in this subject, later to go into any details of it.

Mr. C. E. W. DOW. I would like to ask Mr. AYER if he kept any record of the power required to drive the fan in the system that he speaks of.

Mr. GEORGE A. AYER. I would like to say, Mr. President, that we did know exactly what the power cost. I have not in mind the figures but it was some expense. But I still depreciate the idea or the underlying motive, apparently of the question, which seems to conceive of the idea that I am trying to undermine or to set one side the well recognized method of humidifying. I will say this, perhaps in answer, that if the gentleman will closely scan the cost sheet of that mill and of the production of that mill, they will find the cost in that. It is all there: whether it be good or whether it be bad it is there.

The PRESIDENT. If there is no further discussion, we will proceed to the consideration of the next paper, Roving Traverse Motion, by LOGAN OWEN, Macon, Georgia, which will be read by the Secretary in the absence of the author.

ROVING TRAVERSE MOTION ON FLY FRAMES.

LOGAN OWEN, Macon, Ga.

In a very interesting paper read by Mr. EBEN C. WILLEY before your society at its semi-annual meeting on October 1, 1903, he discussed Roving Traverse Motions on Fly Frames. I confess to a personal interest in the matter, and was, therefore, attracted by Mr. WILLEY'S address.*

This is a subject that has engaged the attention and best thought of practical spinners for a number of years, and it is one that has seemed difficult of a satisfactorily practical solution.

There are so many things to be considered and so many diverse theories to be reconciled that the solution has generally eluded us when it seemed within our very grasp.

Primarily, of course, the consideration has been the quality of the yarn to be produced. This being the first desideratum what was the means by which we were to arrive at the best results? There is the leather covered roll, which, when new and fresh, produces the desired results; but the traverse motion in most general use driven from the back roll by means of a worm and gear, is, in my judgment, too slow. It has not that faculty, to use the vernacular of the day, of getting a move on it. The roving is allowed to stop at the same place on each end of the roll upon each traverse and to dwell there for a con-

* Transactions, Volume 75, page 214. The Adjustment of Cotton Preparing and Spinning Machinery, by EBEN C. WILLEY.

siderable length of time, causing the rolls to become grooved or hollowed at these points. It requires no experience and little reasoning to know that in the ratio that the grooves are worn the roving passes through in a greater or less volume, and, therefore, in this same ratio, is the yarn product varied.

To obtain a yarn of smooth, even uniform appearance and strength, it is conceded that the roving must pass through the rolls in uniform volume and at uniform speed, and it is also conceded that both the volume and the speed are changed and varied in the ratio, that the rolls are smooth or grooved, as above referred to. The device then, that will enable you to prolong the life of the roll and, thereby secure the uniformity of the yarn, is the "consumation devoutly to be wished."

Has this been accomplished with the methods now in use? The question answers itself. Take the rolls from any of your flyer frames and examine them. There are grooves or hollows in them more or less sunken, as they run for a longer or shorter period. It requires constant watching to keep these rolls renewed so that you may present a nearly even surface at all times to the roving. As the rolls are recovered, and the freshly covered ones replace the old ones, the process of grooving begins over again, and this program continues throughout the year with unvarying monotony. But the quality and smoothness of the roving and yarn is by no means unvaried, and this has been the bane of the spinner. Steel rolls have been substituted, but the same old proverb of the constant drops wearing away stones has been illustrated with the additional trouble that the replacing of the steel rolls is more difficult and more expensive. The goal sought then, has been to preserve the roll as nearly intact as is possible. How is this to be done? Obviously by changing the traverse motion so that the roving will dwell at no given point for any considerable time. In a word, a *variable motion*. After an experience extending over some years, and feeling this great necessity I began to study the matter, and prior to Mr. WILLEY'S address had concluded that the help must come through the aid of the lifting rail.

After a number of experiments I have by a system of levers and adjustable joints succeeded in obtaining such a variable motion of the traverse guide that there is practically no change in the surface of the leather covered roll, no matter how long it has been run.

And here is the second important point gained. The life of the roll, as stated, is practically indefinite. I have here samples of rolls that have been in constant use for more than six months without having been recovered or removed from the frames for any purpose. That the saving in material and labor in recover-

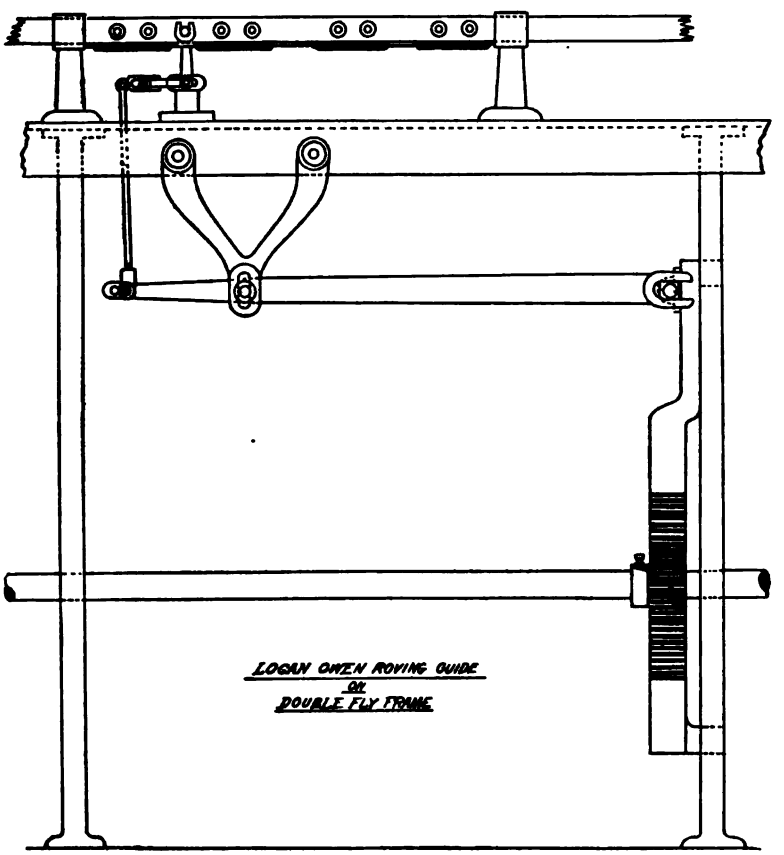

FIGURE 1.

ing and renewing rolls is considerable, is patent to any observer. That the quality of the yarns produced where the rolls retain their uniformity is more regular and of better quality will hardly be questioned.

Following close upon the granting of a patent to me for this device, (a sample of which, with cuts showing its adjustment to either single or double flyers, I have here for exhibition) came Mr. WILLEY'S address. I felt gratified, not to say flattered that he should have fallen on almost the exact line of thought that I had pursued to what I believe is a successful conclusion.

I may add that four of the mills of Bibb Manufacturing Co., of Macon, Ga., viz., Mills No. 1 and No. 2, at Macon, Ga., Taylor Mill at Potterville, Ga., and Porterdale Mill at Covington, Ga., are equipped with this device, and it is enough to say that the results have been very satisfactory, so much so, that there is no thought of returning to the old method.

I ask the attention of those present to my device, and if I shall convince some of you that I have helped to solve the somewhat difficult problem I shall feel that I have not labored in vain.

The SECRETARY. Mr. OWEN has sent a pair of rolls for your examination, and the letter stated that they had been in use a very long time.

The PRESIDENT. I will call upon Mr. JOHN TEMPEST MEATS to open the discussion on this paper.

Mr. JOHN TEMPEST MEATS. I notice that this application applies to roving frames only. In my judgment it is equally applicable to spinning frames or mules, but the particular application illustrated here would not apply to filling frames. Therefore I have given the secretary details of an automatically vari-

able roving traverse motion which is applicable to any kind of spinning or roving machine. I think the thanks of this Association are due Mr. OWEN not only for calling attention to the importance of preserving top roll covers in good condition, but also for having made a practical demonstration of the economy of the variable roving traverse motion. Some mills, particularly in England, have practiced this economy for years. And although I am talking against my own personal interest now, I would say that if I had to buy spinning machinery I should insist upon an automatically variable roving traverse motion. Of course, owing to the present condition of things, where the lowest priced machine is usually purchased, the maker of machinery cannot afford unnecessarily to add to the cost of its construction. But I think the purchaser could easily afford to pay for a device

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

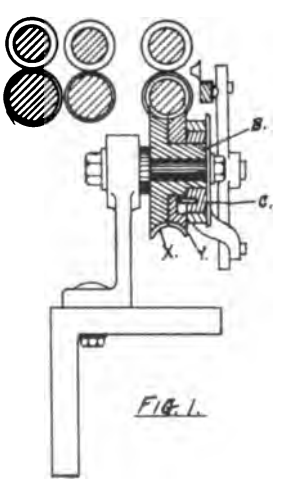

FIG. 1.

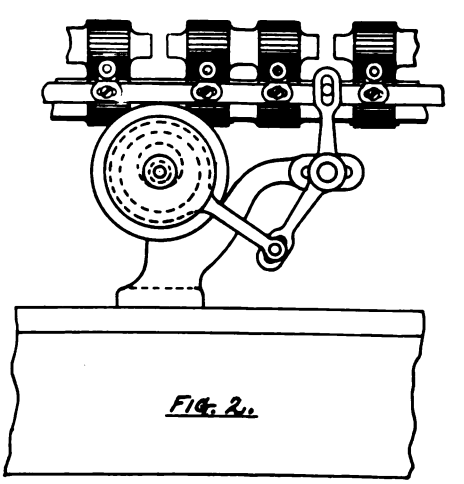

FIG. 2.

of this kind which would pay for itself in the saving in covering of top rolls in a comparatively short time, and would also improve the quality of the yarn by virtue of the superior evenness due to a uniform draft.

Referring to the illustrations:

Figure 1 represents, in cross section, the patent automatically variable, roving traverse motion as devised by Mason Machine Works, and which is applicable to any roving or spinning machine.

Figure 2 represents a back view of the same.

Figures 3, 4 and 5 represent the different positions of the inner eccentric "B" in relation to the outer eccentric "C" and the difference in the length of traverse effected by their changing positions in relation to each other.

Figure 6 is a diagram showing the variation effected in the traverse of the roving guide during one revolution of the worm gear "Y" upon the hub of the worm gear "X" the outer end of the latter being turned down to form the eccentric "B". The eccentric "C" is driven by the worm gear "Y" through the pin as shown; and the eccentric "B" is a part of, and revolves with, the worm gear "X" as already explained; but as there is a difference in the number of teeth in the gears "X" and "Y" the eccentrics "B" and "C" gradually revolve upon each other and so constantly change the traverse of the roving guide. It will be seen that the worm gears "X" and "Y" are represented as driven by a worm or thread cut into the back bottom roll in the usual manner; but it will also be seen that they may be driven by a separate worm, through gearing driven from any suitable point.

The PRESIDENT. Any further discussion? As there is no further discussion, gentlemen, we will proceed to a consideration of the last paper for this session, "The Thomas Yarn Assorting Balance," by GEORGE THOMAS, Manchester, England, which will be read by the Secretary in the absence of the author.

THE THOMAS YARN ASSORTING BALANCE.

GEORGE THOMAS, 72a Deansgate, Manchester, England.

Every spinner, manufacturer, yarn and cloth merchant, in fact all who have to deal with yarn or cloth, of any kind of fibre, will admit the necessity of being able to calculate or determine the number or count of yarn, which the spinner has to spin, or, in the manufacturers' case, the yarn from which a certain cloth has been woven, and in the merchant's case, to be able to check the two former.

With our Patent Universal Yarn Assorting Balance this is easily and exactly ascertained, even from very short lengths of

FIGURE 1. THE UNIVERSAL YARN ASSORTING BALANCE.

yarn which may be taken from small samples of cloth. This Yarn Balance indicates with equal exactitude the counts of cotton, woollen, worsted, silk, linen or jute goods, also from warps or wefts of union fabrics, that is, made of different fibres in warp and weft. The manipulation of the balance is extremely simple, no weights are required and no alteration in the balance when testing yarns of different fibres.

Before proceeding to explain the manipulation of the Balance we will first give a brief description of its construction. Refering to the illustration. The Beam BB, is made of special wire and bent at its fulcrum to an acute angle and rests in its centre C, supported on the knife edge A. The eye M in A, prevents the beam from falling out, and keeps it always in its proper place. P, is a pendulum which serves to keep the side arm E always in a horizontal position, this arm E, being also counterbalanced by the counterpoise E. The beam on its right hand side swings inside a guide which also acts as a protection to the delicate beam. The beam BB, carries at each end a hook of different weight. The one at H, is the yarn hook on which the yarn to be tested must be placed; the other is the weight, made in the form of a hook, as experience has shown its usefulness in testing fine numbers, that is, for instance, if too many ends have been placed on the yarn hook instead of removing the superfluous ends, others can be added on to the weight hook until it balances and then deducting these latter number of ends from those on the yarn hook. The whole is mounted on a brass stand of suitable height. The back plate S of the balance, is black to facilitate a correct observation. As shown by the illustrations it is not necessary that the balance be placed in a perfectly horizontal position as usual by set screws, as it may even be inclined either way, held in the hand.

The operation of the balance is as follows:

Take the templet corresponding to the yarn to be tested, that is, if cotton yarn, the cotton templet, etc., and place same on the cloth so that its sides are parallel with the warp and weft respectively, cut a piece exactly the size of the templet, then

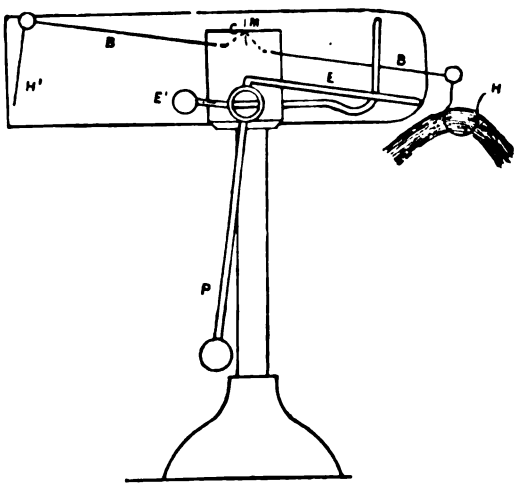

FIGURE 2. SIDE DIAGRAM OF BALANCE.

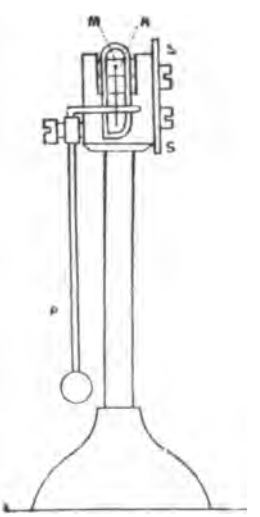

FIGURE 3. END DIAGRAM OF BALANCE.

withdraw the threads from the bit of cloth and hang them on the yarn hook until the scale balances, that is, until the beam BB be parallel with the side arm E; the number of ends or threads then represents the exact count of the yarn, thus it will be seen that in this balance the yarns are made to be their own weights and to indicate their own counts.

If testing yarn direct from the cop or bobbin or hank, it is wrapped round the templet and cut at each end, thus in each case the length of each thread or end to be placed on the hook must be equal to the side of the square templet.

If it is desired to ascertain the counts of yarn in goods which are made of warp and weft of different fibres, a piece must be cut the size of each respective templet, or a piece may be cut the size of the larger templet, then place in the corner, at right angles, edge to edge on the bit, the templet representing the other raw material or fibre and cut off the superfluous piece on one side, so as to leave the length of warp and weft as for templet of the respective materials, and proceed as before.

It is a well known fact that the yarns in cloths are not laid in a straight line, but in a wavy one, on account of the crossing of warp and weft. The thread is, therefore, a little longer than an unwoven yarn, or the templet to which the cloth is cut, and will, therefore, weigh proportionately heavier. For this difference an allowance of $\frac{1}{16}$ inches or $\frac{1}{8}$ inches must be made, for instance, the thread of a bit of cotton cloth cut to templet No. 1, (for cotton English counts) is $2\frac{3}{8}$ inches or $\frac{19}{8}$ inches; long but if drawn out straight, may equal $\frac{20}{8}$ inches thus the count is not 19s, if 19 threads are wanted to balance the scale, but $\frac{19 \times 20 = 20s.}{19}$

This waviness of the yarn is, of course, more in coarse and closely woven goods, than in fine calico or cloth in which latter it is practically nothing.

For dyed and sized yarns extra weight of two to twenty per cent. must be allowed for, thus for fine colors the counts will be

apparently lower by two to five per cent. and for medium colors five to ten per cent. and for dark colors or if heavily sized, ten to twenty per cent. which respective percentages must be taken into account to get the actual count of the gray. For instance, yarns dyed or sized to the extent of ten per cent. will show on the balance as No. 20, whereas, in a gray state the yarn is really 22s counts.

For this reason the warp of woven goods in the gray and the weft of cloths that have been afterwards dyed, printed or finished, should be treated in the same way, that is, the count of yarns taxed two to ten per cent. finer, according to circumstances.

For fine yarns, say 100s to 200s, the operation is facilitated by adding the steel wire reduction hook, when only ten to twenty threads, instead of 100 to 200 respectively, are required to balance the scale. In case it is preferred to obtain the counts of yarn from bits of cloth double the size of the templets, add to the weight hook H, the small wire S shaped doubling hook and proceed as usual.

FOURTH SESSION.

THURSDAY AFTERNOON, APRIL 28, 1904.

The Association met in Huntington Hall at 2.30 P. M., President WALMSLEY in the chair.

The PRESIDENT. The first paper this afternoon is upon Gas Power Applied to the Textile Industry by B. H. THWAITE, of Great George Street, Westminster, London, and in the absence of the author the paper will be read by the Secretary.

The SECRETARY. Mr. President, a number of years ago I bought a book on "Depreciation in Factories," by B. H. THWAITE, of England, and used it in consideration of some matters that I had then had in hand. Last year I met in New York a Mr. THWAITE of England, and I said to him that I was under great obligations to a man of a name similar to his own and that he was the only man of that name whom I had ever met, and referred to the book, and he confessed himself to be the author. He is one of the best authorities, I understand, on the subject of gas engines, and it occurred to me that it would

be very acceptable to this Association if he would give the result of his experience, from his own standpoint, and if he had occasion to speak about his own work, to do so, if that was the last chapter in the history of gas engines. I should state that I gave him a set of the papers read at our Berkshire meeting when I saw him, which will explain the reference to a paper read at that meeting, which he makes in his opening lines.

GAS POWER APPLIED TO THE TEXTILE INDUSTRY.

B. H. THWAITE, C. E., 29 Great George Street, Westminster, London, S. W., England.

The author has had the privilege of perusing a paper on "Mud Fuel" contributed at the Berkshire meeting of this Association by Mr. EDWARD ATKINSON.* In this paper Mr. ATKINSON suggests that the solar thermal effect or the sun's heat is transmitted not as radiant heat but as vibrating impulses through (interplanetary) space to the atmosphere of the earth, which in their passage through the atmospheric envelope, generate heat by the effect of frictional resistance.

Mr. ATKINSON'S ingenious theory is almost identical with the one formulated by the author in the pages of the London Electrical Review under the nom de plume of "Delta." † The difference between the two theories is slight; what Mr. ATKINSON designates as vibrations or undulations, the author defines as electrical waves.

Mr. ATKINSON in his most suggestive paper, is satisfied that the wasteful steam boiler and engine will soon give place to the internal combustion, or gas engine, for all stationary power requirements, and he suggests that the *bog fuel* with

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*Transactions of the New England Cotton Manufacturers Association, Vol. 75, p. 189.

†An Electrical Hypothesis Explaining the Solar and Planetary Phenomena." Electrical Review (London) of February, March and April, 1898.

which he has experimented will be suitable for making heating gas for driving gas engines. Now this mud fuel differs very little if any from peat.

Years ago, the author carried out a series of experiments in making power-gas with Irish peat. The peat was fed into the author's Cupola Generator, the gas produced was introduced into a gas engine and acted perfectly, the indicator diagram of power was very little different from that obtained with poor coal.

In the year 1889, in a lecture on Mill Engines delivered before the Yorkshire College Textile Society,* the author made the following remarks:

"Some one stated not so long ago (probably 1885) that the time was approaching when the steam engine would only be found in museums as a type of an obsolete motor. There are no grounds for such a prophesy."

The whirligig of time has its revenge on those who dogmatize too emphatically on the future values of instruments of contemporary science and engineering, and the author has himself been compelled, in the face of the irresistible evidence that his own experience has produced, to withdraw the statement which placed the steam engine on a plane of almost impossible displacement.

The author's investigations into the question of generating motive power by direct combustion commenced soon after he delivered the lecture on Mill Engines already referred to. In his investigations almost every available fuel was employed, ranging from wood, charcoal, peat or bog fuel, coke, coal, both anthracite and hydrocarbonaceous, and he found that all these fuels are available for producing motive-power-gas.

The result of the author's work and especially that associated with the harnessing of the waste gases from blast furnaces to

* Which is interesting because of the fact that in the published report there is a long letter received by the author from GEORGE CORLISS, the last statement or report from this illustrious American engineer describing the efficiency of his engineering creation.

gas engines, has been the elevation of the gas engine high, and over possible competition by the steam engine, whether rotative or reciprocating.

The remarkable success attending the employment of the waste gases with their $\frac{90}{110}$ British heat units of thermal value per cubic foot was immediately followed by an increase in the power units of internal combustion engines, and today single unit quadruple cylinder engines of 3,000 indicated horse power are available for the power user. One of the main issues of the author's investigations was the fact that by the physical compression of the explosive mixture, a combustible gas of almost any thermal value above 50 British heat units per cubic foot can be employed in a gas engine.

The author realized that if the density of the poor combustible gas was increased by physical compression to a certain degree, the sluggish inflammability of the gas would disappear, and the gas and air would ignite with sufficient rapidity and certainty of effect to satisfy internal combustion engine working requirements.

This fact, once demonstrated, brought into the field of future service, the enormous volumes of waste gases that flow into and pollute the atmosphere at every iron-making centre, and in the United States alone, the potential of power of the furnace gas from the American furnaces is counted in hundreds of thousands of horse power.

To meet the demand for engines to convert usefully the awful waste of power, many eminent engineers on the continent of Europe have for several years been applying almost their entire attention in designing engines to secure all the qualifications that a steam user and electric supply consumer must have, and in Germany alone it is said that over 50,000 horse power of large capacity gas engines are in active service.

Ironmasters are under a great obligation to the textile manufacturers for the enterprise that has been devoted to securing the most economic steam power instrument, and today the finest examples of land-steam-engines are still to be found in textile

mills. In return the ironmasters have helped by their enterprise to bring the gas engine up to the level in power unit capacity and reliability of the steam engine, so that the account of obligations will now be balanced.

As a result of the author's success in harnessing the waste gases from the blast furnace to a gas engine, he was permitted in 1897–98 to displace a steam engine by a gas engine in a textile factory near Leeds, a power gas generator of the author's design permitting the gas to be supplied from coke breeze.

The power user of this plant has kept his gas engine in daily service now for some six years, and he is, if possible, more enthusiastic today in his appreciation of this direct power producing method than he was in the earlier stage of its operation.

Now, assuming all other conditions to be equal, it should be obvious that the direct combustion, or oxidation of fuel behind a piston, which is pushed forward by the expansion of gases as the effect of such combustion must of necessity be more thermally economical than the steam power system is or can ever be, and no wonder when it is remembered that the solid fuel is indirectly and wastefully burnt, generally at atmospheric pressure in a steam boiler furnace flue, the steam thus produced sustaining in addition a thermal loss by condensation between the boiler and the steam engine cylinder.

We all know that in a steam boiler the fuel is as a rule burnt anyhow, either with too much or too little air, and the losses of heat by condensation influences culminate in their aggregate effect, in condemning the steam engine as an instrument of low thermo-dynamic 10–12 per cent. efficiency under best every day conditions of running, whereas a well designed gas producer and gas engine will give a combined advantage of at least twice that of a steam power plant, and this result is obtained in every-day running work, and not merely in tests in which every possible condition is assured to produce the best thermal results. A gas engine should develop an *indicated horse power* hour for a carbon consumption of 0.75 pounds, whereas no reciprocating steam engine under ordinary working day by day and week by week

conditions will secure this time energy of one horse power hour for a less expenditure than 1¾ pounds of carbon. We know that tests have been made from time to time with high class steam engines, in which the expenditure of carbon or combustible has been as low on one day as 1.59 pounds per indicated horse power hour; but on the following day the expenditure rose to 1.86 pounds and for the same time energy development.

Mr. GEORGE CORLISS, in a letter to the author, gave the expenditure of coal (not qualified as to combustibility) as being equal to 1.626 pounds per indicated horse power hour.

In addition to the steam provided for power development, the same steam generating plant provided heat for warming the mill during the winter months and for the vapor pots in the weaving shed and steaming room.*

This example of CORLISS Practice must be equalled not only thermodynamically, but also in the facility the steam power system provides in supplying the steam or an equivalent agent for heating purposes.

It may be pertinently asked in what way can compensation be supplied for this steam heating advantage, if gas displaces steam power.

An analysis of a gas engine's thermal or heat expenditure shows that from 20 per cent. to 30 per cent. of the heat supplied is converted into dynamic energy, 20 per cent. is carried away in sensible form by the exhaust gases and the balance of the thermal energy supplied to the engine (after allowance for the effect of the increase of the specific heat with temperature) is absorbed by the jacket water.

The hot jacket water will be available for heating purposes. If steam is, however, required, the cylinder jacket water can be used as the agent of evaporation, and the steam can be generated by the combustion of the gaseous fuel in a suitable water tube boiler.

* Exceptional figures equivalent even to a lower fuel expenditure than the ones quoted for steam power have been published, but the author with all respect, doubts their accuracy as representing every-day working conditions.

The hot exhaust gases from the gas engine, can be employed directly for warming by radiation service arrangements, or they may be made available for further heating or warming services by introducing into the exhaust silencing chamber a tubular steam or air heating apparatus. The air may be forced through the tubes and will be available for ventilation purposes or for blowing up the generator fires.

Advocates for steam power may argue that if so much more heat is expended in developing a given dynamic power than is required with gas power, that, nevertheless, a considerable portion of the thermal balance existing as exhaust steam is more or less usefully absorbed in the service of the textile process in steam heating. To some extent this may be correct, but it must not be forgotten that the superior thermal efficiency of the gas engine is really due to the perfection of combustion of the fuel, and therefore, the advantage is a power-generic one, and as we know, the thermal value represented by the exhaust gases and the cylinder jacket water can be brought into service as effectively as that of exhaust steam.

The disadvantages of steam power now have obviously a dual origin: —

Firstly: By the defective combustion arrangements of steam generating appliances, and

Secondly: In the imperfect thermo-dynamic efficiency of the steam engine, per se.

The author in his lecture 16 years ago, emphasized the importance of separately adjudicating the efficiency of the *two* main operations involved in steam power production, that is, keeping the steam boiler distinct from the engine, and in modern thermal balance sheets this is done. The author publicly advocated the importance of establishing municipal stations for calorimetric determination before Mr. B. DONKIN emphasized its advisability and he again urges the importance of indicating the efficiency of all power generating stations in the equivalents of the British heat units absorbed in developing

power and over lengthened periods of at least one week of ten hour days.

In the lecture referred to, the author suggested that power plant should be measured in terms of the mechanical equivalents of heat, say 100 equivalents equalling 77,200 foot pounds.*

In the application of the author's gas power system to the driving of a textile factory, the cylinder jacket water is used for dyeing purposes, the exhaust gases are used for warming purposes and the sensible heat of the producer gases is utilized to heat the air required to support the gasification process and also for drying purposes. It is claimed that the process gives a return either as power, or *heat*, of 80 per cent. to 90 per cent. of the heat stored in the fuel used in the gas generator.

A typical thermal balance of every day running is made up as follows, the expenditure includes for week-end stand-by losses. Heat value of fuel = 100.

Producer Gas Generation.	Per cent.	Gas Engine and Heating Appliances.	Per cent.
Heat absorbed in gasification and radiation	10	Heat converted into work =	18.5
Sensible heat returned by air heater or recuperator . . .	9	Hot water from cylinder jacket, used for dyeing purposes .	44.5
Chemical heat value of producer gas in holder	81	Heat rejected as sensible available for dyeing, etc. . . .	18.0
		Balance absorbed in gasification	19.0
	100.		100.

Particulars of a test made with a Thwaite Power Gas Plant driving a textile factory.

Diameter of cylinders	16″
Length of stroke	24″
Revolutions per minute	140

* The author suggested in 1889, that the 100 equivalents might be termed Watt Joules, this was before the date of the absorption of these names in defining electric energy equivalents.

Explosions per minute	140
Mean initial pressure	297 lbs.
Mean effective pressure	78 lbs.
Indicated horse power	133
Producer Gas per hour, main	10,640 cubic feet.
Producer Gas per indicated horse-power per hour, main	80 " "
Coke used per indicated horse-power per hour	99 lb.
Actual Carbon used after deducting 15 per cent. of ash	0.74 lb.

The thermal value of the producer gas at 32° Fahrenheit down to 212° Fahrenheit is 128 British heat units. The gas is represented by the following composition: — in volume percentage.

	Per cent.
CO_2	3.4
CO	27.8
H & CH_4	7.4
N	61.4
	100.

Figure 1 shows a general plan of a gas generating and gas power plant, showing the arrangement by which the hot jacket water is returned to the hydraulic bath of the gas generator, the hot exhaust gases are used to heat the air in its way to the gas generating plant.

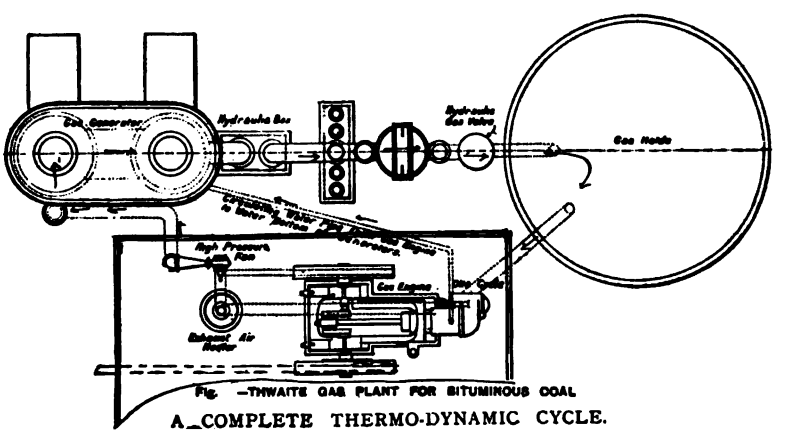

FIG. —THWAITE GAS PLANT FOR BITUMINOUS COAL

A—COMPLETE THERMO-DYNAMIC CYCLE.

FIGURE 1.

Figure 2 shows a view of the Thwaite generator, of a power gas producing capacity of 300 – 500 indicated horsepower.

FIGURE 2. THWAITE 500 HORSE POWER GAS GENERATOR FOR DRIVING TEXTILE GAS ENGINES.

Figures 3, 4 and 5 show plans and elevations of the Thwaite Patent Gas Engine, quadruple cylinder, vertical, tandem type, of 1,500 indicated horsepower capacity, arranged for rope driving.

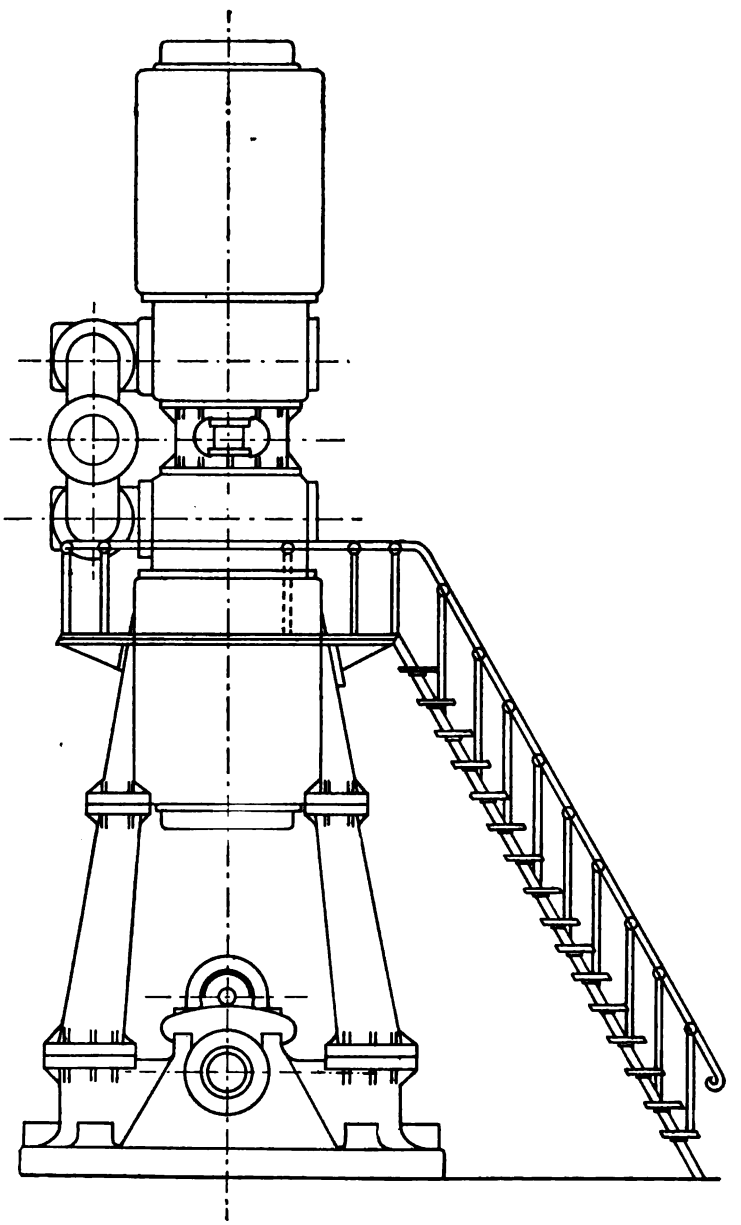

FIGURE 3. THWAITE 1500 HORSE POWER PRODUCER GAS ENGINE.

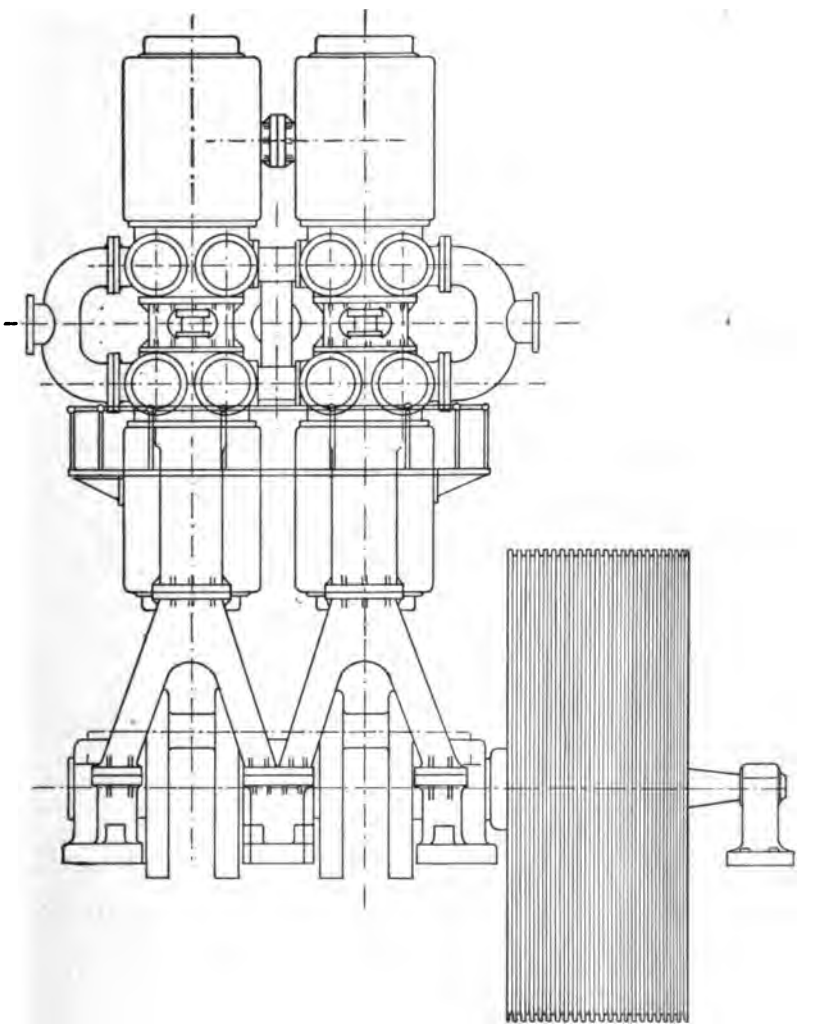

FIGURE 4. THWAITE 1500 HORSE POWER PRODUCER GAS ENGINE.

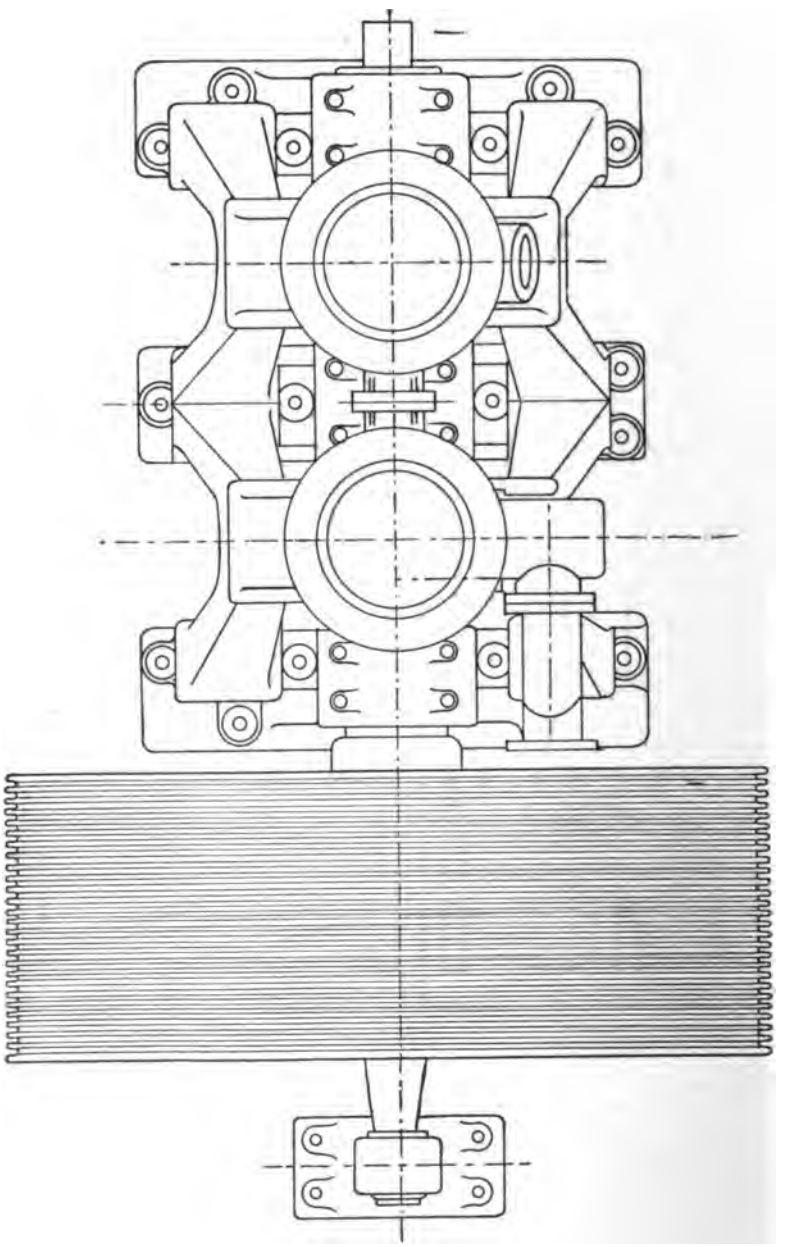

FIGURE 5. THWAITE 1500 HORSE POWER PRODUCER GAS ENGINE.

Outside the question of thermal efficiency there is a duty for all of us, and one that has hitherto been altogether neglected, but which it is a crime against natural laws to overlook, and this consists in preventing as far as it is possible the smoke pollution of the atmosphere, a product of imperfect combustion.

The danger of polluting water, whether river or stream, is admitted, and in England it is illegal to introduce impurified and innocuous effluents into water flows, but surely the pollution of lung food, or air, is as objectionable as the pollution of liquid stomach food, or water.

We know that carbon completely oxydized to carbondioxide by the process of combustion is then in a condition suitable for absorption by the vegetable world, and supplies one link in the endless chain of Nature's wonderful scheme of the conservation of energy; but, on the other hand, carbon monoxide gas, the result of the partial or incomplete oxydation of carbon, cannot be assimulated by vegetation, and is, moreover, a poisonous gas. Now one of the greatest disadvantages associated with steam power is the fact that it is responsible for the major part of the atmospheric pollution, which is proceeding day and night throughout the manufacturing centres. The more or less complete removal of this is one of the advantages that can be claimed for gas power.

The admirable Otto-Lenoir Cycle of a modern gas engine in which the gas and air are drawn into the cylinder together and are there compressed to a high degree before being ignited, secures ideal combustion conditions, and the result is, that the exhaust gases of any well-designed engine, indicate on their analysis that more or less complete combustion is being obtained all through ordinary working conditions, and this almost independently of expert supervision.

The PRESIDENT. Mr. ATKINSON, will you open the discussion?

Mr. EDWARD ATKINSON. Mr. President, I read this paper last evening with much interest. In the first place, reference was made to the mud fuel. Mr. THWAITE assumes that mud fuel differs but little from peat. Now, this is a probable error. I don't know precisely the qualities of the material on which they are experimenting, either in Scotland or in Ireland. The Scotch peats are the high moss peats, which are not equal to the bog fuel with which we are dealing. I have some of the mud from the bog of Antrim, which is more nearly like ours, and they are now working that rather extensively for heating purposes, and are also making a very strong, solid cardboard from the sod which is on the surface which is not yet fully carbonized. The mud fuel which we have been testing varies in thermal units from 67 per cent. of the value of ordinary bituminous coal up to even 90 per cent., so that there are very great variations, probably due to the quality and kind of plants and to the manner in which they have decayed. What we call the grass peats, which have decayed and formed probably very slowly, make a homogeneous black mud of very high calorific value and very high value in production of gas. We are at the beginning only of this investigation.

Next, I observe that Mr. THWAITE says that we are under great obligations to the textile manufacturers for their work. But he does not begin to give the credit that should be given to the textile manufacturers of this country for what has been done. He appears to strike a sort of average of 1¾ pounds per horse power per hour. Now, when I investigated this matter for the Mutual Boiler Insurance Company some time ago, in order to determine if I could, what were the relative values of the various smoke-preventing apparatus and fuel consumers, I listed some hundred and odd concerns as to their consumption of coal.

No. 1, a cotton mill, working New River coal, 24,000 tons a year, worked at 1.1 pounds during running hours continuous

work under the constant supervision of a graduate of the Institute of Technology, and at 1¼ pounds per hour including the banking up. I don't think the managers of that concern would object to my mentioning the name, the Merrimac Company. A large plant using New River coal, 13,000 tons a year, worked continuously, including, as I remember, the banking up, at 1¼ pounds of coal per horse power per hour, and that test was made by Mr. BARRUS at the Lancaster Mills. There are several others much better than the credit that Mr. THWAITE gives to the American textile manufacturers. Down to the time of this investigation the great Boston pumping engine out at Chestnut Hill held the best record, and Mr. FITZGERALD assumes that nobody could ever equal it because the conditions could never be the same. They had worked continuously at 1.1 pounds and are undoubtedly working at that figure now. That is a continuance pumping engine of slow motion. This table runs from that figure up to five pounds per horse power per hour in a great western concern located where coal is very cheap, and they are using 30,000 tons a year. I have plenty of these reports in the office of the Mutual Boiler Insurance Company. It is interesting to note the remarks on the different stokers and on the different up-drafts and down-drafts and other preventions of smoke. The conclusion which I reached and which most of us had reached was that the best smoke-preventer and the best fuel-consumer was a good, intelligent fireman, well paid, and I don't doubt that will gradually cease to be the fact. It is undoubtedly true that, step by step, the automatic stoker will take the place, it is already taking the place, of the average fireman, because in too many concerns it is assumed that anybody can shovel coal, a very expensive way of saving wages. We have plenty of these reports for anybody who will come down to the office and call for them.

It will also be observed that there are enormous differences in the calorific value of the different coal. We have a report on another interesting investigation, in which, taking Pocahontas as the standard at 100, the best Cumberland standard at 100,

the New River shows a value of 97, the Clearfield, 92; the Youhiogheny, 89; the Hocking Valley 82; and Novia Scotia, 81. So that there are nearly as great variations in the thermal units of calorific value of different coals that you buy as there are in the different examples of bog fuel. Of this report we also have plenty of copies in the Mutual Boiler Insurance Company's office, and I will ask the Secretary to print this report in the Transactions of the Association in connection with these remarks.*

We also have a final report on whether it is best to cover your bituminous coal under a shed or not. We rather object to sheds, because they bring wooden material often in contact with coal, and as the wood ignites at a lower temperature than the coal does, several of the worst fires in coal heaps have occurred from the heating of the coal up to the point of ignition of the wood, and then the wood igniting set the coal on fire. This is an interesting line of investigation.

But to go on to the further point of the gas engine, its reliability is thoroughly established and the firm of Loomis, Pettibone & Co. are now prepared to sell and guarantee their gas engines at from 100 to 5,000 horse power per hour and guarantee a pound of fuel to the horse power per hour. That proves the superiority in getting the power out of the fuel, and that is the great point. I observe that Mr. THWAITE goes back to the steam engine on account of the utilization of the steam after the power has been generated and undoubtedly, there is a large recovery of the waste of the steam engine, especially where heating buildings and all that sort of thing are to be conducted. But here comes in another factor; at the cylinder of the gas engine, after the gas has done its work in the engine, the heat is discharged at about 1,200 degrees. Now, Mr. LOOMIS proposes to jacket that cylinder and conduct that heat into the coking and continue his coking with it after he has got his power out of it and that is a perfectly feasible thing to do in the mill, because hot water heating is now taking the place

* See page 308, Steam Making Value.

of steam heat, in some of the best mills, and it ought to in all office buildings and dwelling houses. And there you have your heat at the cylinder which you can carry over to heat your hot water, even if you cannot make steam with it, and circulate that through your mill and have your mill better heated than you can with exhaust steam. So that even starting at the initial point that by coverting the fuel into gas you do get about double of its potential into work, I think you may then go on and continue the saving of the otherwise wasted heat, just as you now save your exhaust steam. Therefore, I will say that with what little I know, from observation, and right here let me say that I have just conferred upon myself a new title or degree which I am going to ask the American Academy to confer by and by — that of D. S. — "Duffer in Science." [Laughter.] My observation leads me to think that you can utilize the heat of the gas engine as you do the exhaust steam, and thereby enjoy the benefit of 22 to 25 per cent. of the potential of your fuel in place of the present 10 or 12 per cent. in the steam engine.

If it were not for facts like these I should not dare speak in the confident way that I have spoken of the fuel today, even from our own laboratory experiments because I have to make believe that I don't believe it myself. It opens such a visionary potential that it seems incredible that it should have been left for a Duffer in Science to stumble into it. When my little invention in the diffusion of light was being tested by Professor NORTON in another hall nearly as big as this, one of the dark rooms, with every window darkened and only a 12 inch pane. through which the light came, he happened to have it in the plain glass with a ray of light striking down to the floor and the rest of the room utterly dark. One of the oculists from the neighboring Harvard Medical School came in at the upper door and stumbled down to the centre, barking his shins on the way until he got to where he could stand, and then NORTON threw in the ribbed glass. Straightway it was daylight all over the room. The doctor looked up and said, "Why didn't some donkey ever think of that before ATKINSON?" [Laughter].

Now, there are a good many things for the donkeys to pick up, just as I picked up this mud fuel while I was nibbling corn stalks to see if I couldn't compress corn stalks and grow fuel, and I happened to think of the mud as I rode down to Mattapoiset.

Now, Mr. BURDETT LOOMIS you all know about; he is the original inventor of the Loomis Producer Gas, and he and his associates are now the largest producers of gas plants and gas engines. They have just brought the Cudahy property at Milwaukee where they are now building a large establishment. He came to see me — he is a quiet old gentlemen — and he sat with me for two hours, and when we got through I found that he had taken up my first pamphlet more than a year ago and had been following it on his own behalf and had come to certain conclusions. He said, "It will take four tons of the crude mud" — in which I think he rather exaggerates — "to make one of dried, or two tons of dried to equal a ton of coal." I think there he is in error. We find that one ton dry weight of the fuel from the great Cedar Swamp that lies between Easton and Taunton will make nearly an equal quantity of better gas, higher illuminating power, than one ton of average gas coal. Mr. LOOMIS takes the conservative side, claiming that four tons of crude make one ton of dry, and that two tons of dry are equal to one ton of coal. He says, "We can handle that at 20 to 25 cents per ton." That establishes the gas fuel at less than $2.00 Mr. NORTON and myself can't get it as high as that. He says this will be a very simple matter to do. And when at the end of my conversation I said, "Mr. LOOMIS, your conclusion seems to be that at any point where coal costs $2.50 a ton or possibly $2.00, if there are these mud bogs near, as they are throughout the whole North, coal is out." And then, I said, after he assented to that, "Doesn't that mean revolution?" "This," he said, after giving these figures, "would surely mean a revolution in the development of power where coal is above $2.00. If we find a bog where it is not desirable to make the power, then we can pipe the gas to such points as it is needed. We

can use the poorest part of the gas on the spot, and the best gas can be used for forging, annealing, tempering, melting of iron and brass, singeing of cotton cloth, etc." He then offers all that I can possibly ask of him in aid of putting up the little apparatus which we propose to put in presently down at Easton, near the Ames works, where the mud is. I have reckoned that down there in that one bog, if it is as large as it purports to be, there are about 150,000,000 tons at 25 feet. The engineer who is picking up a little parcel of it at five dollars an acre built the railroad across it, and they had to drive a great many of their piles over 40 feet. The brass workers in Connecticut find that the coke made from this material, being free from sulphur and phosphorus, makes it perfectly certain that in their works their brass will not become brittle, and that with every kind of coke that they have ever used, is the thing to avoid and extremly difficult to avoid. The coke made from the moss peat, which are not nearly equal to ours, have an immense preference over every other kind in Europe.

We are now at work on the secondary products not yet complete, which will probably give some startling results when we get the complete analysis.

The great Cedar Swamp is the only one, it is the largest one, but I should guess that there were 500 million tons of potential fuel within thirty miles of where I am now speaking, and that is probably true of almost every manufacturing town or city from here to the Rocky Mountains north of the Ohio and the Potomac rivers, that being the limit of the glacial period. These deposits are coal in its primal formation, forming in the pockets or depressions that were left by the action of the glacier without water enough to make a lake in which these various plants have grown for ages, dropping over and decaying under water, the nitrogenous portions converted into marsh gas or will-o'-the-wisp by the microbes that live in the water and not in the air, while the carbons and the hydrocarbons are preserved by immersion in the water. All previous efforts to utilize these materials down to within two or three years have been devoted

to attempts to compress, either drying first, which is especially difficult in respect to the moss peats, which are very spongy, and not possible with respect to the mud peats, because they can be no more compressed than water. Other efforts have been made to dry them, pulverize them and then press them, but, as I stated in one of my reports, a German chemist discovered that the vescicles containing hydro-carbon were broken up and the viscous adhesive hydro-carbon would then spread itself through the mass, serving as a natural bond, and then, if dried, it would shrink from 6 down to 1 and presently shed water and not absorb water, and burn from the outside without becoming friable, and that proves to be the fact.

Now, it happens that nearly all the European machines correspond in their general way to the machine which I happened to invent in 1867, when we worked common peat bricquetts for the Indian Orchard Mills for one or two years, and which Mr. N. W. FARWELL afterwards worked for two or three years more down at Lewiston. We gave it up when coal got down to $5 a ton. This machine broke up the vescicles of hydro-carbon and made a harder material, and I observed at that time, but I did n't know what it meant, that our bricquettes were much more solid than those made in the ordinary way. I ought to have had gumption enough to have followed it up, but I did not. By patenting that machine I have cut off any possible patent on anything of the same kind. These European machines are all developed on the same idea as mine, an alternate series of ploughshares, cutting knives and hooks, and mine was the simplest, and Mr. NORTON, with his customary gumption, has simplified mine, and that little machine which some of you saw working this morning, is simply a modification and improvement of the original machine, and it will be made for $30 or $40 with a capacity of ten tons a day and one horse power.

Now, gentlemen, what does that mean? Here is the highest authority preparing to go to work. Here are the laboratory experiments in which we have tried and tried to find a snag or an out. What does it mean? Does it spell revolution? I have

to, as I say, make believe that I don't believe in it. It is probable that the muds of the South are different. The glacial cap extended to the mouth of the Delaware. The mud of the Dismal Swamp and that of the savannahs and the lagoons of the South, so far as we know them, approach more nearly to lignite than to what we call peat, and in lignite the chemical action of the hydro-carbons has gone further towards a solid condition than it has in these mud fuels, and yu cannot break up the vescicles, apparently, and it would be more difficult to handle it. But for gas purposes I do not believe there will be any difference, and that they can be converted, because in the Producer gas process the whole of the carbon is exhausted. They will not be able to make coke, perhaps, as well as we can.

I will also say that General DRAPER owns a bog in the neighborhood of Hopedale from which we are making one of the finest cokes that can be made. I have sent up to the St. Lawrence River, where there are millions and millions of tons of black sand, mainly consisting of magnetic iron ore, which they have never been able to smelt. Following the practice in Germany we propose to mix the black sand and mud into bricquettes, and those bricquettes will serve the smelting purpose. We will get out the metal, and if it does not, as I fear, contain too much titanium, we may have another great source of magnetic ore.

That is as far as I have got. I have to hold myself down and hitch my foot sometimes under the table for fear I shall go up in a gas bag. [Applause.]

STEAM MAKING VALUE.*

We give herewith a revised table on the comparative evaporative power of coals in stationary boilers.

The tables are based on boiler tests, calorific tests, and proximate and ultimate analyses. Circulars No. 3 of Steam Users Association, No. 5 and No. 8 of Mutual Boiler Insurance Company gave various of the details on which the results are based.

First. We have adopted as our standard a coal containing about 15,800 B. T. U. per pound of combustible. Most of what is sold as Pocahantas coal and the very best quality of Cumberland coal appears to have this value, which is called 100% in the tables.

While some of the coals are used by but few of our members, the values will be of interest in comparing records of plants in other regions with their own records.

The coke referred to in the table is that of the New England Gas & Coke Company, and the value is based on boiler tests, and on proximate and ultimate analysis.

By capacity is meant the ability to evaporate steam with a given grate area and draft pressure irrespective of the amount of coal used per pound of steam. This will, of course, vary even more largely than the amount of coal per pound of steam. Both are average results, and the figures for capacity are hardly more than rough estimates.

It should be remembered, of course, that a slower burning coal can be made to give a greater capacity merely by increasing the draft.

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* This is the article referred to on page 302.

As stated in our previous circulars, steam-making value is the only criterion used in making up the table given below.

Freedom from danger of spontaneous combustion, smokelessness, convenience of handling and firing, etc., are things that affect the value very differently in different plants, and are, therefore, not considered in making up the table of evaporative values.

The table is a table of averages so that single lots of coal will be apt to be better or worse than the average values of their grades, both in the evaporative power of the combustible and more especially in the quantity of refuse. The tabulated values, especially those that are based on only a few experiments, such as the values of the Pittsburg and Ohio coals, and the coke, may need later revision. In regard to the coke, however, there seems to be no probability that its true average value will be found below 84% or above 91% of the best soft coals.

We are not prepared to offer any general set of specifications or rules for tests for purchasing coal, but we shall be glad to prepare such to suit the cases of individual members that may ask for them.

We also offer the services of our inspectors and engineer to our members who may desire to have their coal tested. When requested, the boiler inspectors will, on their regular visits, collect at the mills or yards a sample of the coal, and the Mutual Boiler Insurance Company will have the same tested, either by its own or an approved chemist, and will report on same.

The charge to cover the expense of collection and the analysis has been set as follows:

Earthy matter,	$4 00
Proximate analysis (moisture, volatile hydrocarbon, carbon and ash)	6 00
Ultimate analysis (moisture, C. H. O. N. S. and ash)	15 30
Calorimeter test,	15 00

We are equipped for making complete boiler tests, including calorimetric determinations of the steam, and analysis of the flue gases, and have made a number of such tests in previous

years. It is impossible to make any stated price for boiler tests, as the expense and time required vary so much in different cases, but we shall be pleased to submit estimate whenever required.

Comparative Evaporative Powers of Coals and Coke Compared with the best Soft Coals.

SOFT COALS.	Combustible.	Probable per cent. of Refuse.	Coal as Bought.	Relative Capacity Irrespective of Economy.
Pocahontas	100	7½	100	100
Best Cumberland	100	7½	100	90 to 100
Average Cumberland	98	7½	98	90 to 100
New River	95	5	67	90 to 110
Clearfield	95	10	92	85 to 100
Pittsburg (Youghiogheny)	88	6	89	80 to 100
Ohio (Hocking Valley)	80	6	82	90 to 120
Nova Scotia	83	10	81	70 to 90
Anthracite Steam Coals and Coke.				70 to 90
Coke (New England Gas and Coke Co.)	91	9½	89	All broken hard coal.
Lykens Valley Pea	96	15	88	70 to 90 Chestnut.
" " Buckwheat	96	18	85	60 to 80 Pea.
Wyoming Pea	95	15	87	55 to 75 Buckwheat.
" Buckwheat	95	18	84	45 to 75. Rice.
Schuylkill Pea	93	15	85	35 to 55 Culm.
" Buckwheat	93	18	82	25 to 45
Lehigh Pea	91	15	84	
" Buckwheat	91	18	81	

The PRESIDENT. The next paper on the Approximate Costs of Mill Buildings by CHARLES T. MAIN of Boston, Mass., is a most useful contribution in giving rapid and I believe accurate methods of estimating costs of mill buildings.

APPROXIMATE COST OF MILL BUILDINGS.

CHARLES T. MAIN, Boston, Mass.

It is sometimes convenient to be able to tell off hand the approximate cost of proposed buildings, or the cost if new of existing buildings without going through an estimate of all the quantities of materials and labor.

It is not an uncommon thing to hear the cost of mill buildings placed from 60 to 80 cents per square foot of floor space, regardless of the size or number of stories. There is, however, a wide range of cost per square foot of floor space, depending upon the width, length, height of stories and number of stories.

We recently placed a valuation upon a portion of the property of a corporation, including some 400 or 500 buildings. In order to have a standard of cost from which to start in each case, we prepared a series of diagrams showing the approximate costs of buildings varying in length and width, and from one story to six stories in height. The height of stories also was varied for different widths, being assumed 13 feet high if 25 feet wide, 14 feet if 50 feet wide, 15 feet for 75 feet, 16 feet for 100 feet and over.

The costs used in making up the diagrams are based largely upon the actual cost of work done under average conditions of cost of materials and labor, and with average soil for foundations.

The costs given include plumbing, but no heating or sprinklers.

USE OF DIAGRAMS.

1. The diagrams can be used to determine the probable approximate cost of proposed brick buildings to be used for

manufacturing purposes, and these can be taken from the diagrams readily. For example, if it is desired to know the probable cost of a mill 400 feet long by 100 feet wide by 3 stories high, refer to the sheet showing the cost of three story buildings. On the curve for buildings 100 feet wide, find the point where the vertical line of 400 feet in length cuts the curve, then move horizontally along this line to the left hand vertical line, on which will be found the cost of 66 cents. For present prices of materials and labor, add about 5 per cent. making the total about 70 cents per square foot.

The cost given is for brick manufacturing buildings under average conditions, and can be modified if necessary for the following conditions.

a. If the soil is poor or the conditions of the site are such as to require more than the ordinary amount of foundations, the cost will be increased.

b. If the end or a side of the building is formed by another building, the cost of one or the other will be reduced.

c. If the building is to be used for ordinary storage purposes with low stories and no top floors, the cost will be decreased about 10 per cent. for large low buildings to 25 per cent. for small high ones, about 20 per cent. usually being fair.

d. If the buildings are to be used for manufacturing purposes and are to be substantially built of wood, the cost will be decreased about 6 per cent. for large one story buildings to 33 per cent. for high small buildings, and 15 per cent. would usually be fair.

e. If the buildings are to be used for storage with low stories and built substantially of wood, the cost will be decreased from 13 per cent. for large one story buildings to 50 per cent. for small high buildings, and 30 per cent. would usually be fair.

f. For office buildings the cost must be increased according to the finish.

The cost of very light wooden structures is much less than the above figures would give.

The table which follows the curves shows the approximate

ratio of the costs of different kinds of buildings to the cost of those shown by the curves.

2. The diagrams can be used as a basis of valuation of different buildings.

A building, no matter how built nor how expensive it was to build, cannot be of any more value for the purpose to which it is put than a modern building properly designed for that particular purpose. The cost of such a modern building is then the limit of value of existing buildings.

Existing buildings are usually of less value than new modern buildings for the reason that there has been some depreciation due to age, and that the buildings are not as well suited to the business as a modern building would be.

Starting with the diagrams as a base, the value can be approximately determined by making the proper deductions.

3. The diagrams can be used as a basis for insurance valuations after deducting about 5 per cent. for large buildings to 15 per cent. for small ones, for the cost of foundations, as it is not customary to include the foundations in the insurable value.

BASIS OF ESTIMATES.

The following table shows the costs which form the basis of the estimates, and these unit prices can be used to compute the cost of any building not covered by the diagrams.

The cost of brick walls is based on 22 bricks per cubic foot, costing $15.00 per thousand laid. Openings are estimated at 33 cents per square foot, including windows, doors and sills.

Ordinary mill floors, including timbers, planking and top floor, with Southern pine timber at $30.00 per thousand foot board measure and spruce planking at $20.00 per thousand, cost about 25 cents per square foot, which has been used as a unit price.

Ordinary mill roofs covered with tar and gravel, with lumber at the above prices, cost about 20 cents per square foot, and this has been used in the estimates.

Add to above for stairways, elevator wells, plumbing, partitions and special work.

The present prices for materials and labor would increase the cost as shown on the diagrams about 5 per cent.

DEDUCTIONS FROM DIAGRAMS.

1. An examination of the diagrams shows immediately the decrease in cost as the width is increased. This is due to the fact that the cost of the walls and outside foundations, which is an important item of cost, relative to the total cost, is decreased as the width increases.

For example, supposing a three story building is desired with 30,000 square feet on each floor.

If the building were 600 feet by 50 feet its cost would be about 80 cents a square foot.

If the building were 400 feet by 75 feet its cost would be about 71 cents a square foot.

If the building were 300 feet by 100 feet its cost would be about 68 cents a square foot.

If the building were 240 feet by 125 feet its cost would be about 66 cents a square foot.

2. The diagrams show that the minimum cost per square foot is reached with a four story building. A three story building costs a trifle more than a four story. A one story building is the most expensive. This is due to a combination of several features.

a. The cost of ordinary foundations does not increase in proportion to the number of stories, and therefore their cost is less per square foot as the number of stories is increased, at least, up to the limit of the diagrams.

b. The roof is the same for a one story building as for one of any other number of stories, and therefore its cost relative to the total cost grows less as the number of stories increases.

c. The cost of columns, including the supporting piers and

castings, does not vary much per story as the stories are added.

d. As the number of stories increases, the cost of the walls, owing to increased thickness, increases in a greater ratio than the number of stories, and this item is the one which in the four story building offsets the saving in foundations and roof.

3. The saving by the use of frame construction for walls instead of brick is not as great as many persons think. The only saving is in somewhat lighter foundations and in the outside surfaces of the building. The floor, columns and roof must be the same strength and construction in any case.

TABLE SHOWING RATIO OF COST OF BUILDINGS DESIGNATED, COMPARED WITH BRICK MILLS OF STANDARD CONSTRUCTION.

Superficial feet of Floor in one story.	FRAME MILLS						BRICK STORE HOUSES						FRAME STORE HOUSES					
	1 Sto.	2 Sto.	3 Sto.	4 Sto.	5 Sto.	6 Sto.	1 Sto.	2 Sto.	3 Sto.	4 Sto.	5 Sto.	6 Sto.	1 Sto.	2 Sto.	3 Sto.	4 Sto.	5 Sto.	6 Sto.
1250	.859	.675					.798	.728					.696	.505				
2500	.862	.727					.845	.725					.747	.578				
5000	.888	.779	.751	.726	.703	.674	.833	.800	.777	.764	.755	.748	.744	.602	.561	.531	.508	.483
7500	.895	.791	.765	.738	.716	.690	.852	.807	.783	.772	.763	.755	.765	.625	.581	.551	.530	.506
10000	.904	.801	.775	.749	.727	.703	.866	.813	.790	.778	.770	.762	.784	.645	.602	.574	.552	.527
15000	.913	.816	.792	.769	.747	.724	.887	.825	.805	.792	.783	.775	.810	.678	.638	.610	.588	.563
20000	.919	.833	.810	.787	.765	.743	.896	.836	.817	.804	.795	.786	.824	.703	.667	.637	.614	.590
25000	.923	.847	.824	.802	.781	.758	.905	.847	.828	.815	.805	.796	.834	.720	.685	.655	.632	.608
30000	.927	.858	.835	.814	.795	.770	.910	.856	.836	.823	.814	.805	.841	.733	.697	.667	.645	.621
35000	.930	.865	.844	.821	.804	.778	.915	.864	.842	.830	.821	.812	.848	.741	.706	.677	.655	.632
40000	.933	.870	.848	.828	.810	.786	.919	.869	.848	.835	.826	.817	.855	.749	.715	.687	.665	.643
45000	.936	.873	.852	.832	.815	.792	.922	.872	.852	.839	.831	.822	.861	.758	.723	.697	.676	.653
50000	.939	.875	.855	.836	.818	.797	.924	.875	.856	.843	.834	.826	.869	.767	.732	.707	.686	.664

PRICES AND OTHER DATA USED FOR ESTIMATING THE COST OF BRICK BUILDINGS FOR TEXTILE MANUFACTURING.

	FOUNDATIONS including excavations. Cost per lin. ft.		BRICK WALLS. Cost per sq. ft. of surface.		Columns including piers and castings.
	for outside walls.	for inside walls.	outside walls.	inside walls.	Cost of one.
One Story Building.	1.75	1.50	.33	.40	12.00
Two " "	2.50	2.00	.37	.40	12.00
Three " "	3.25	2.50	.40	.40	12.00
Four " "	4.00	3.00	.43	.40	12.00
Five " "	480	3.50	.46	.40	12.00
Six " "	5.80	4.00	.50	.40	12.00

ASSUMED HEIGHT OF STORIES.

From ground to first floor 3′
Buildings, 25′ wide, stories, 13′ high
" 50′ " " 14′ "
Buildings, 75′ wide, stories, 15′ high
" 100′ " " 16′ "
" 125′ " " 16′ "

Floors, 25 cents per square foot of gross floor space.

Roof, 20 cents per square foot. Roof to project 18″ all around buildings.

Stairways, including partitions, $100 each flight.

Allow 1 stairway and one elevator tower for buildings up to 150′ long.
" 2 " " " " " " " " " 300′ "
" 3 " " " " " " " over 300′ "

Plumbing, $75 for each fixture including piping and partitions.

Allow 2 fixtures on each floor up to 5,000 square feet of floor space and add 1 fixture for each additional 5,000 square feet of floor or fraction thereof.

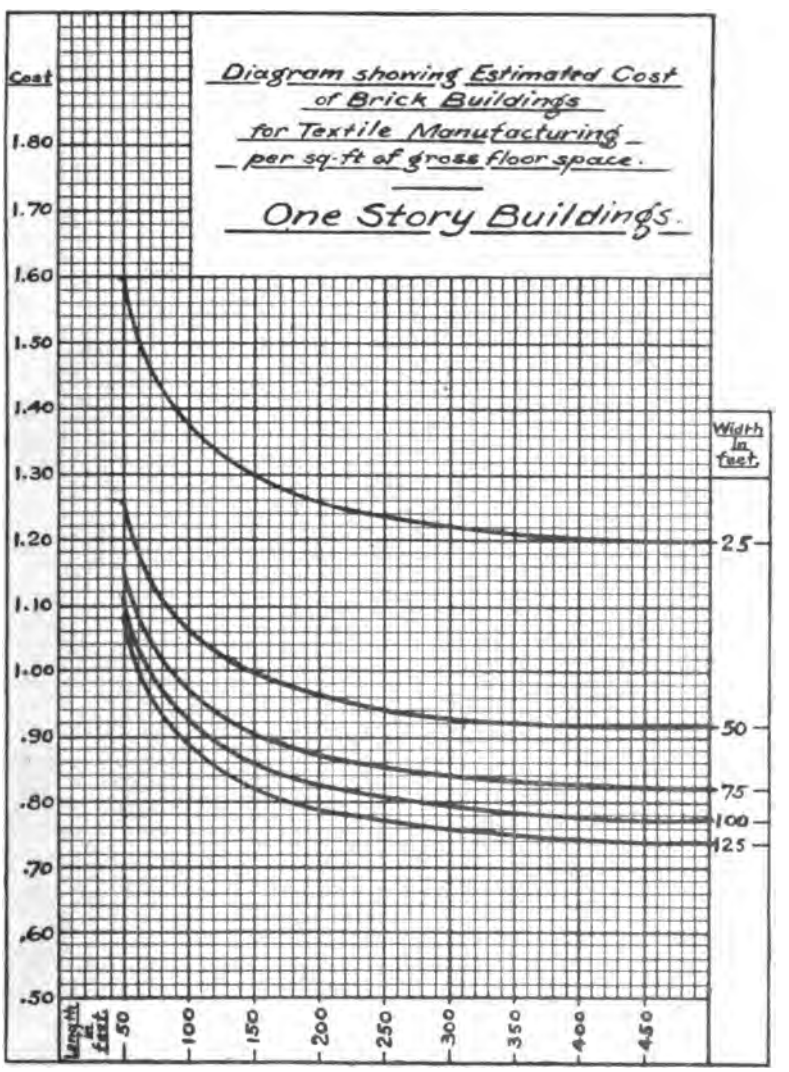
Diagram showing Estimated Cost of Brick Buildings for Textile Manufacturing per sq. ft of gross floor space.
One Story Buildings.
Cost
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
Length in feet.
50
100
150
200
250
300
350
400
450
Width in feet.
25
50
75
100
125

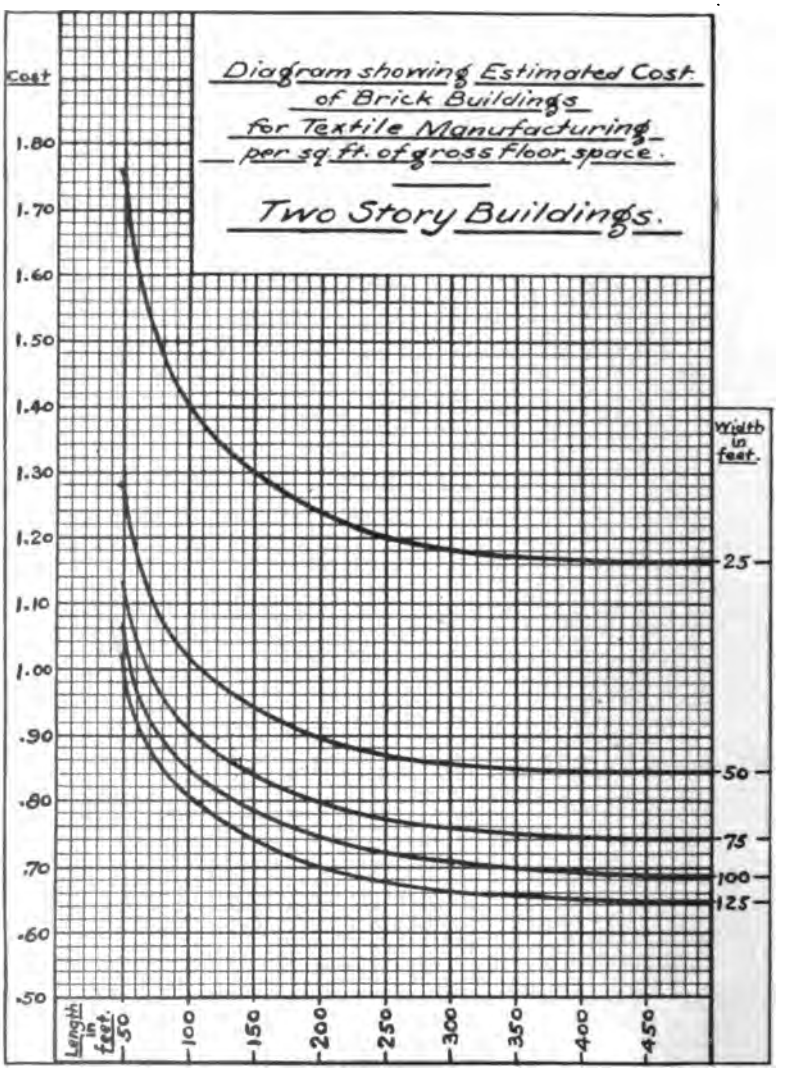
Diagram showing Estimated Cost of Brick Buildings for Textile Manufacturing per sq. ft. of gross floor space.
Two Story Buildings.
Cost
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
Length in feet.
50
100
150
200
250
300
350
400
450
Width in feet.
25
50
75
100
125

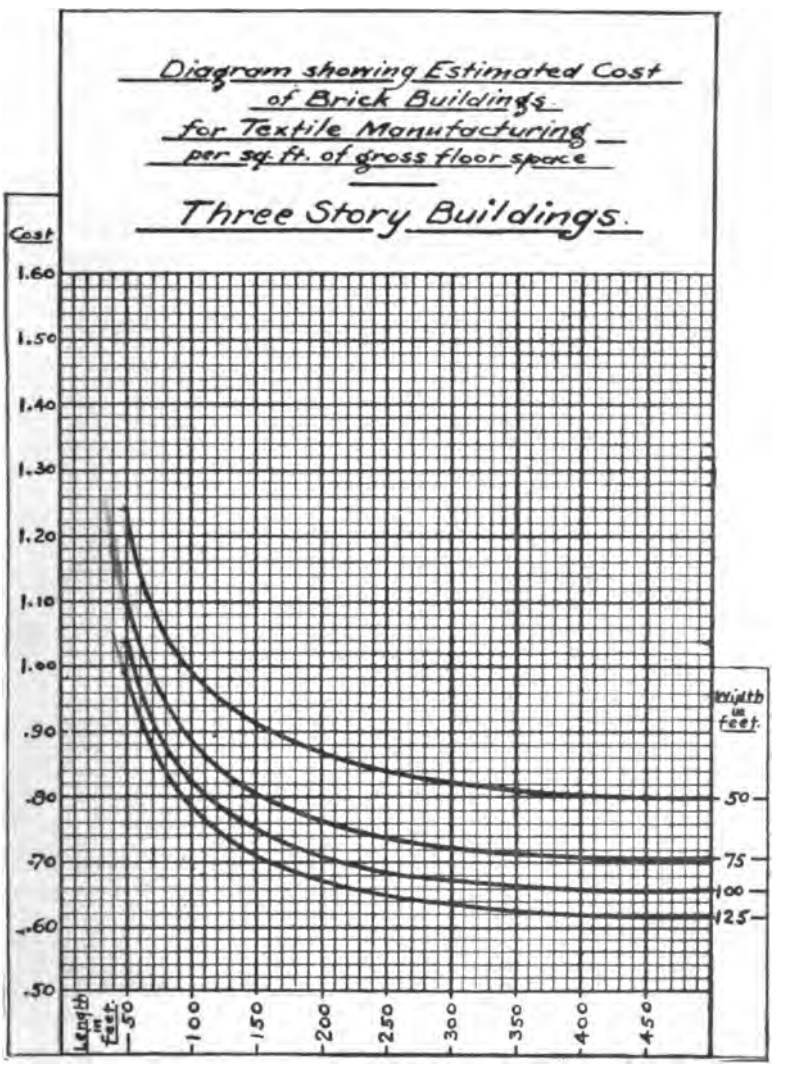
Diagram showing Estimated Cost
of Brick Buildings
for Textile Manufacturing
per sq. ft. of gross floor space
Three Story Buildings.
Cost
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
Length in feet.
50
100
150
200
250
300
350
400
450
Width in feet.
50
75
100
125

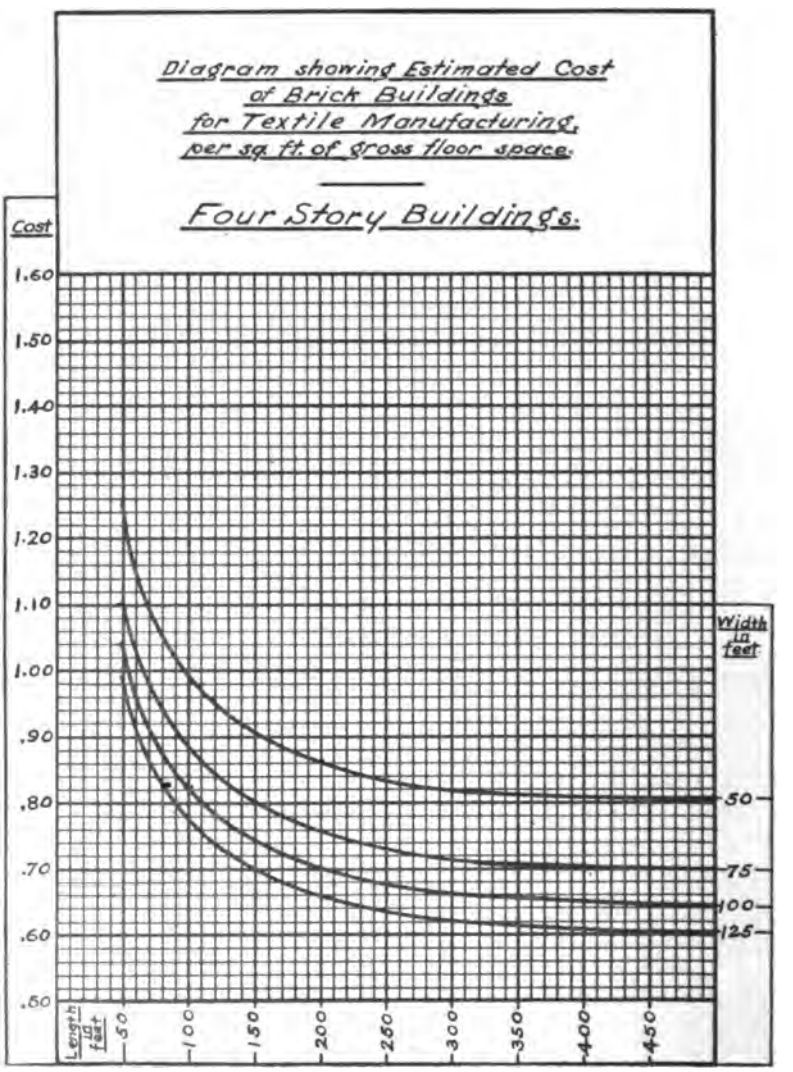
Diagram showing Estimated Cost
of Brick Buildings
for Textile Manufacturing,
per sq. ft. of Gross floor space.
Four Story Buildings.
Cost
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
Length in feet
50
100
150
200
250
300
350
400
450
Width in feet
50
75
100
125

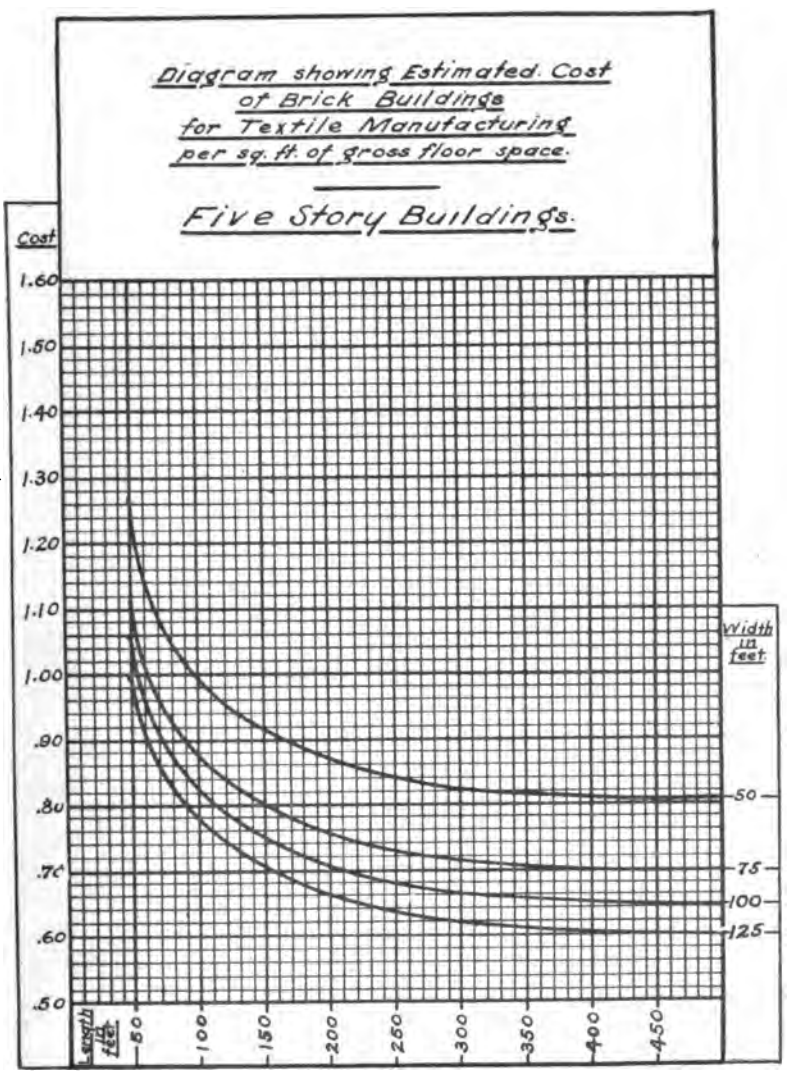
Diagram showing Estimated Cost of Brick Buildings for Textile Manufacturing per sq. ft. of gross floor space.
Five Story Buildings.
Cost
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
Length in feet
50
100
150
200
250
300
350
400
450
Width in feet
50
75
100
125

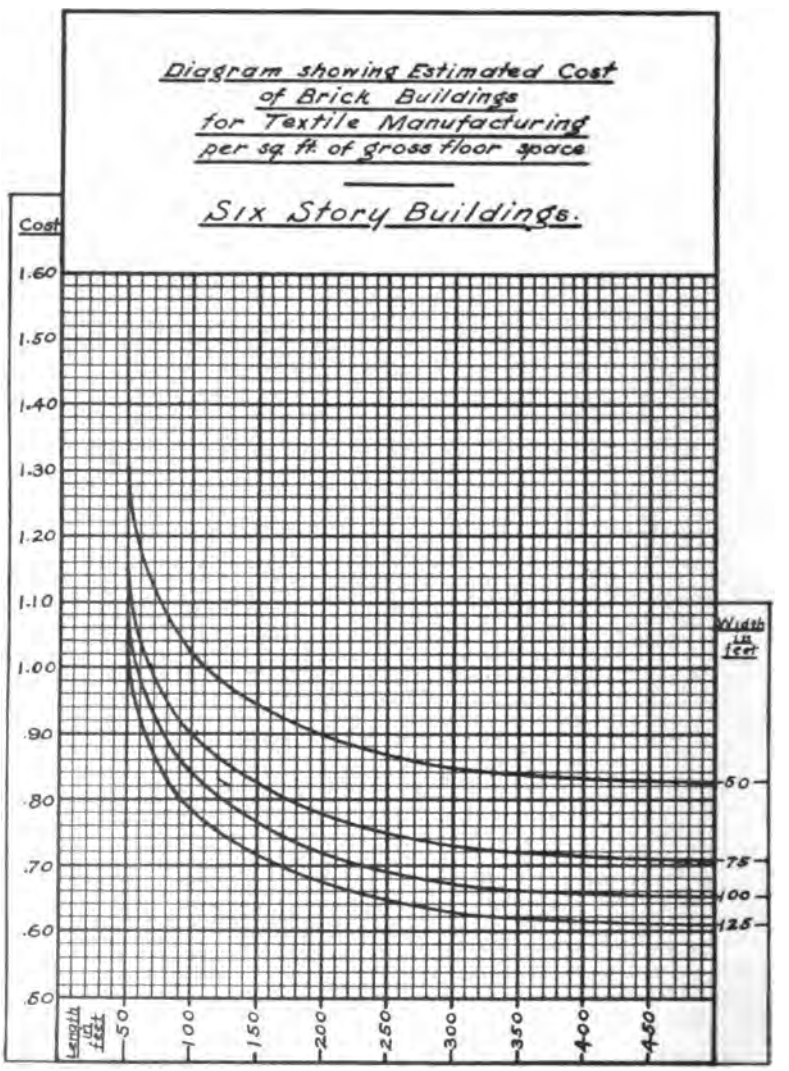
Diagram showing Estimated Cost
of Brick Buildings
for Textile Manufacturing
per sq. ft. of gross floor space
Six Story Buildings.
Cost
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
Length in feet
50
100
150
200
250
300
350
400
450
Width in feet
50
75
100
125

The PRESIDENT. Gentlemen, we are indebted to Mr. MAIN for the information contained in his paper, as we are likewise indebted to him for previous papers. Is there any one who desires to discuss this paper or to ask any questions? I presume there will be no discussion, but I feel sure that the paper will be carried home for reference.

The next paper, gentlemen, is "The Electrical Transmission of Power," by ex-President EDWARD W. THOMAS, Columbia, South Carolina. In his absence, Mr. Secretary, will you be good enough to read the paper?

The SECRETARY. Mr. THOMAS had expected to be here and to submit a long and exhaustive paper on the subject of the electrical transmission of power. It was found, however, that some results were anomalous and he ascertained that some accident had happened to one of the ammeters, after a long series of experiments and observations during regular operation of the mill had been carried on, and this necessitated readjustment of the instruments and the repetition of the whole work. However, he has prepared another paper, but meantime he has been bereaved by the death of his father, so that he is unable to be here today.

THE ELECTRIC TRANSMISSION OF POWER.

By E. W. Thomas, Columbia, S. C.

It is now barely ten years since the electric drive was first accepted to be the sole drive of an individual cotton mill.

This plant was placed in the Columbia Mills, at Columbia, S. C., and was the result principally of the foresight of the then manager of the plant, Mr. CHARLES K. OLIVER, who with the courage of his conviction equipped the complete mill with this form of transmission, and the idea of dividing the machinery into sections each of which had its individual motor was first introduced by him. Soon after this equipment was in operation, the Pelzer Manufacturing Company, of Pelzer, S. C. adopted this principle, but in their case a portion of their motive power was steam.

About this time also the Ponemah Mills, of Taftville, Conn. substituted the electric drive in a large weave shed, for their steam direct drive. Full details of the installation of these plants may be found in papers presented to this Association at the April meeting of 1895 and published in volume number 58 of the Transactions page 216. These papers give very fully the details of the installation and so very thoroughly, that it is needless to repeat the deductions arrived at in this paper.

Nine years have passed since their presentation, and the conclusions arrived at then, from the experience up to that date, in the mills quoted, are still in force today.

The Columbia Mills plant, quoted by Mr. PAINE, in his paper, which has been in operation for about ten years, and running more or less over time, is a striking example of the freedom from trouble by use of the electric drive.

It was visited by the writer within a few days, and the management made the statement, that during all the years of its operation, no trouble had arisen to change their opinion of the drive, and they fully endorsed the letter of the treasurer of the mill, which was published in Mr. PAINE'S paper, and which appears in the Transactions of the Association.

The result of these two mills has been such, that today one Electric Company alone, has furnished to the single state of South Carolina, distributed among about thirty textile plants, generators of a capacity of nearly 40,000 horse power and motors aggregating about 30,000 horse power and to this should be added the sales made by other manufacturers of electric equipment.

The cotton mills of New Hampshire, Massachusetts and Georgia have each many plants that have successfully installed electric driving. There can be no question but that electric driving has come to stay.

In the city of Columbia, S. C. are six cotton mills, five of which are electric driven. Four are driven from a central water power plant and one, the larger mill of the number, has its own steam generating plant and electric equipment, and from this plant is driven the last of the six mills.

From personal observation and supervision, I can say that, day in and day out but little if any trouble occurs in these plants from the use of the electric drive.

One of these mills, the Olympia, designed and erected by Mr. W. B. S. WHALEY, is 553 feet in length, by 151 feet in width and four stories in height and contains complete equipment for 100,320 spindles, now installed and in successful operation.

The generating plant consists of three McIntosh & Seymour engines each of a normal rating of 1,600 horse power capable

of developing a maximum of 2,000 horse power direct connected to alternating current generators. The engines are of vertical cross-compound condensing type with cylinders 23 and 48 inches in diameter and a stroke of 42 inches. The cylinders are steam jacketed and a reheating receiver is placed between them. The steam pressure is 165 pounds, and the makers guaranteed that the steam consumption would not exceed 12.7 pounds per horse power per hour.

The generators are 1,300 kilowatts capacity, each with 36 poles, run at 133 revolutions per minute and deliver current at 600 volts. The entire electrical equipment was furnished by the General Electric company.

The motor equipment for driving the mill, consists of twenty-two type L. induction motors of 150 horse power each, current at 550 volts and running at 600 revolution on no load, and 588 revolutions on full load. The motors are suspended from the ceiling of the different floors and most of them are placed in the middle of a 12 feet length of shaft, the motor shaft being coupled directly with the line shafting, except in the case of the motors driving the carding and weaving machines where a counter shaft is necessary, on account of the slow speed of these machines.

The power house is located at the center of the rear of the building, and the distribution of the motors of the mill is as follows:

In the opening room are 5 openers and 1 thread extractor, driven by a 20 horse power belted motor.

In the picker room are 5 breakers, 10 intermediate, and 10 finisher pickers driven by a 150 horse power motor.

In the card room, over the cards are two motors, 150 horse power each, one driving 88 cards, and the other driving 62 cards, both being belted motors.

There is one motor of 150 horse power driving the slubbers, intermediate roving frames and all the drawing frames.

The fine roving frames, 96 in all, containing 13,984 spindles, are driven by two belt driving motors of 150 horse power each.

In the driving of the 100,320 spinning spindles, are 10 motors of 150 horse power each, having the following number of spindles on each motor.

2	motors	with	10,032	filling	spindles	each
2	"	"	10,560	"	"	"
2	"	"	9,504	warp	"	"
2	"	"	10,032	"	"	and
1	"	"	4,752	filling	"	"
			5,280	warp	"	"
			4,224	filling	"	"
			8,808	warp	"	"

Making a total of 100,320 spindles. The spindles are number 2 Draper, and the warp rings are 1¾ inch diameter and the filling rings are 1⅜.

These 10 motors, driving the spinning, are direct connected to the shafting, so that to drive this entire 100,320 spindles, there are only two lines of shafting, no counter shafts or belts; the only belting required, being that from the shaft to the tight and loose pulleys on the frames, the latter belt being but 2¾ inches in width. The shafting runs at the speed of 600 revolutions per minute, and the driving pulleys 33½ inches diameter for warp frames and 31 inch diameter for filling frames, the pulleys having wood rims. Probably this spinning room stands unequalled in the small amount in weight of its pulleys and shafting, and the small amount of belting, required for the number of spindles operated.

The spoolers and warpers are driven from the weave room lines, the amount of power required to run these machines, being so small as not to require their being driven by an individual motor.

The six slashers in the mill are being driven by a belted motor of 20 horse power which also operates the large STURTEVANT fan for expelling the vapor arising from size boxes and the surface of the cylinders.

The looms are situated on two floors, and the shafting is located in the lower weave room. The driving of the 2,250 looms is as follows:

1	motor	150	horse power	464 — 40″ looms
1	"	"	"	486 — " "
1	"	"	"	391 — " "
1	"	"	"	585 — " "
1	"	75	"	324 — " "

Cloth room with four sets of cloth room machinery and baling press is driven by a 50 horse power motor.

Besides the foregoing motors, there is one located in the machine shop and four more directly connected to the feed pumps, supplying water for the boilers, tanks and toilet rooms, and for cooling the transformers.

Tests of the power required by the foregoing motors operating the textile machinery show, that of the total power required:

The picking consumes	4.42 per cent.
Carding department consumes	14.18 "
Spinning "	59.19 "
Spooling, warping, slashing and cloth room consume	3. "
Weaving consumes	19.21 "
	100.00 per cent.

The above mill has been in constant operation for three years.

At another mill located in Columbia, and adjacent to the one just described, which was also designed and built by Mr. WHALEY, there are 57,000 spindles and necessary equipment of looms for same.

This mill is driven electrically from power obtained from a water power company not owned by the mill, the power being purchased at certain price per horse power per year, the cost being based upon the meter readings at the mill.

The power plant is located about one mile from the mill and the same power company also furnishes power to three other mill plants as well as several other local industries.

The division of the machinery in this mill, in sections for each motor drive is as follows:

The opener and breaker pickers are driven from an extended

card room shaft, and the motor which is of 150 horse power capacity, drives also 103 cards and all the drawing frames.

Six intermediate and six finisher pickers are driven by a 75 horse power motor.

All of the roving machinery and 12 spinning frames, are driven by a 150 horse power belted motor. The balance of the spinning frames are driven by six 150 horse power motors.

The spoolers, warpers and slashers, are driven by a 50 horse power motor.

The weaving room by three motors;

1	of	150	horse	power	driving 664 looms
1	"	"	"	"	574 looms
1	"	"	"	"	304 looms

The cloth room containing three sets of cloth room machinery is driven by a 20 horse power motor, and 1 motor of 20 horse power is located in the machine shop.

Tests made at this mill show that of the total power required the

Picking and carding requires	19.45 per cent.
Spinning "	57.80 "
Spooling, warping and slashing requires	2.22 "
Weaving in cloth room requires	20.53 "
	100.00 per cent.

I have given these details of the above plants to enforce the idea of the benefits to be derived from a subdivision of the power into units as large or small as may be desired, and to fit the power required for any department. These two plants have been under my personal supervision for about one year. One, the Olympia, has been in operation for three years, and the other for about eight years, and during my term of service no mishap of any nature, due to the equipment has occurred and I am told that at no time during the entire time the plants have been in operation has any trouble been experienced from the motors and our experience here is undoubtedly that of others operating electric driven plants.

Having had ample opportunity to carefully observe this form of drive for some time, my conclusions are decidedly in its favor.

It occurs frequently in these mills, as it does in most mills, that certain parts of the mill are "out of balance" with other parts, and it may be readily seen that any section, or department, may be run independently from the others.

When certain departments of the mill, say the opener room, picker room, or cloth room, have "caught up" with the work, the throwing out of a switch at the motor by the overseer, stops the machinery in that particular department, without in the slightest effecting any other department.

In the construction of the building no belt towers are required. No large heavy belts, no large head shafts, and the counter belting is materially reduced. The widest belt in either of the above mills is but six inches. Owing to short lengths of shafting driven by each motor, one diameter may be used throughout the mill, which as all mill men know is of great advantage if changes are required in shaft pulleys.

Each motor has its cut out switch near at hand as well as a duplicate one on switch board in engine room or wheel room.

This is an advantage in as much as in case of fire, or accident, the shafting connected with any motor may be immediately brought to a standstill, without the necessity of notifying the engineer or the electrician in charge.

There is one other very important advantage one has in having the electric drive and that is the fact that the actual power required by the machinery on any motor may be known at any time, as an automatic recording instrument may be applied to the wiring at the motor itself or at the switch board in which a continuous record in ink or pencil is transcribed, either upon a circular dial or upon continuous strips of paper.

By these records the variation in the power may be seen at a glance and the study of these variations and their connection with the different degrees of temperature, the amount of humidity is most interesting. Oils may be tested on shafting

and machinery, and the results of the different makes compared.

The tell-tale dial, or strip, show to the manager another very important feature, and that is whether or not from start to finish of the working forenoon, or afternoon, the machinery on the motor was all in operation the whole of the time.

Records have been obtained where it was shown that when the starting time of the mill was 6.30 in the morning, the full amount of machinery was not running until 7 o'clock and the same record shows a dropping off in power from 11.30 to 12, showing that the employees were neglecting the work, preparing to leave for the noon hour.

The engineer or electrician may have on his switch board in the power house watt meters for each motor, and can at any moment see at a glance whether any motor is running in excess of the normal power required.

It must be allowed that this is much more satisfactory than the present "guess work" of trying to obtain the power required for any one room or department, or class of machines from indicator cards from the engine, where, when it is desired to obtain the power required for any one room or class of machines, in most mills it is necessary to run all the shafting in the mill unless there are cut-off couplings provided.

It is also evident that in case of any accident but a minimum portion of the machinery is stopped.

The slashers in the mill are operated through the noon hour so as to avoid stopping any slasher during the running of a set of warp beams.

An interesting point, I think, that is of important advantage is the uniformity of speed obtained by the machinery in the mill.

It has been proven beyond doubt, in case of spinning and weaving, a larger production per spindle and per loom can be obtained by the electric drives over the customary methods of driving.

Many mills have been equipped with this form of driving, and not only have installations been made in newly built mills, but a

large number of mills, whose motive power was generated by steam or water, have changed their system and now use electric drives to their great advantage. To the party building a new mill, and contemplating adding to its capacity later by extending the mill out at either end; the problem has no terrors, he simply extends his mill, places in his motors and extends his wires from the original generating plant and his work is done.

If he incorporates direct belt driving in his new mill at the start, he must necessarily be forced to install shafting of a larger size than is necessary for the first section of the mill, in order to have it of sufficient strength to carry his contemplated extension.

To the manager and the manufacturer who is so unfortunate as to have a group of mills bunched together in an unmethodical system, and so built that from no one unit of power can the requisite distribution be obtained, except by a large amount of shafting and belting, then the ability to wire from the central electrical power plant to his various buildings relieves him from a burden at once.

To the manufacturer having a water power, the advantage of locating his mill elsewhere than immediately adjacent to such power may be of material advantage. It is not a question today of locating the mill buildings at the water side, but contrariwise, distance from power plant to mill is becoming less a factor as the years go by.

Thus in many ways does electric driving open up advantages for a closer study of the power question, and indirectly to provide some means of determining some of the reasons why the percentage of possible productions of the machinery is so low in some of our mills.

It had been my intention in the preparation of this paper, to have presented some tests and data obtained from a careful study of the electric drive as described in the foregoing mills, but as the tests and experiments have not been finished, I have deemed it advisable to present them at some future meeting of the Association if desired.

No single item presents itself to the user of power, especially in the textile industry that is being so fully investigated as that of electric driving.

All through the South may be seen mill after mill equipped with electrical power, some of the mills generating the current by steam engines and others by water power. Large water power developments have adopted the electric current as a means of distribution of power to textile plants, among the latter are the Columbia Power Co., the Catawba Power Co., Columbus Power Co., all of which have large power development and distribution.

There has of late come into the field an improved method of power generation, namely the steam turbine, particularly adapted to operate electric generators, its motion being rotary instead of reciprocal, as is the case with the present steam engine.

The steam turbine will give, or should give, a very uniform speed for the generators as is the case when generators are operated by a water power plant. That the steam turbine has come to stay may be evident from the fact that in the textile lines several mills have already placed orders for turbines in connection with electric driving, and many others are contemplating doing so. The application and use of the electric current as a means of transmission has before it an unlimited field. Hundreds of thousands of horse power of water remain as yet undeveloped throughout the South and West, that some day will be developed and the power thus obtained will be used by the steam railroad as their motive power as well as for distribution for mechanical purposes.

The PRESIDENT. Gentlemen, if I am not very much mistaken, Mr. E. W. THOMAS, who is one of the ex-presidents of this Association, has presented more useful and valuable papers than any other member, and it goes without saying that we are greatly indebted to him. Under such circumstances and in his absence there can be no question that consideration and courtesy call for a discussion of this paper. There are several gentlemen in the room interested and well posted on this question. Will one of them be good enough to open the discussion? There was some discussion on this question yesterday; surely it is not exhausted. Mr. PAINE, may I request you to begin the discussion.

Mr. SIDNEY B. PAINE. Mr. President and gentlemen, I did not see this paper until five minutes ago, consequently I am hardly prepared to discuss it except as I have followed the Secretary as he was reading it.

There are one or two matters in connection with the paper which I think are worthy of note. I hardly think it is necessary to speak about the electric drive in particular. Too many of you gentlemen have it in your mills for me to need to enlarge on that question. Mr. THOMAS has touched upon one question on the eighth (8th) page which I think is one of the most profitable fields that we are investigating at the present time. He speaks of this tell-tale dial or strip which shows the amount of machinery in operation. We have made tests of a number of mills with wattmeters and have kept the curves of operation in these mills. They have shown us some things which were a little at variance with the accepted ideas in regard to a mill. I have in mind at this moment a test that was made on a mill taking nearly 1,700 horse power. We took the readings during the ten (10) consecutive hours with wattmeters. The maximum load in the morning was 1,685 horse power, and this dropped down to a minium in the morning, if I remember correctly, of about 1,640. In the afternoon the load started at about 1,635 and dropped down to about 1,575. That is not strange. But

the singular part to us was that the maximum load did not occur at the time of starting. That is usually accepted as the time to look for the peak. The maximum load occurred along about nine or ten o'clock, possibly, as Mr. THOMAS suggested, because all the machinery was not fully in operation until that time. The minimum load did not occur until just before shutting down. These facts have led us to make a little further investigation, which we are now carrying out systematically. By means of recording or curve-drawing wattmeters we can obtain a curve of the power required by a given motor. This wattmeter may be placed at the motor or at the switchboard, as you please. In case two motors are on the same circuit, of course it would have to be placed at the motor. We find that there is a variation in the power required by this motor, that is, to say the least, startling at times. On ring spinning we should expect that the power would be fairly uniform, as the number of frames stopped for doffing should be in proportion to the number of doffing gangs, and, therefore, the power should be uniform. But we find it exceedingly variable. And by running this down and tracing it out we find there are frames stopped for cleaning, which is contrary to the accepted practice. On weaving we find there are also wide variations. There is one fact that occurs in every weave shop we have tested so far. At about half past eleven the power runs off; at about half past five the power runs off. It is either because the help are going out to wash up, or else, because each one is struck with the same idea, that it is not worth while to put on any new warp for that short length of time. Now by checking this power by means of these power curves, we hope to put in the hands of the manufacturer the opportunity of increasing his production very materially, because he can keep track of the work that is going on his mill as he cannot on the mechanically driven mill. All the departments show this variation.

There is another interesting thing which we have noticed. When we take these several curves of a mill and put them together we get just what would be indicated by your engine, it

is very nearly a straight line. In other words, by the ordinary method of testing your mill as you do today, you satisfy yourselves with the idea that your machinery is running very steadily. If you separate the departments, and especially sub-divide the departments into separate sections, you will be surprised to know how much stopped machinery you can detect.

I don't know that I need to enlarge on the other matters that Mr. THOMAS has brought out. As to the facility for enlargement of the new mill, the case occurs to me while I am on my feet of one party who did try to enlarge, and this was the result: Eight years ago they enlarged their mill; they expected to increase their business the next year; they put in a half cross compound engine, which was the proper thing to do as long as they were going to increase so quickly. For eight years they have been waiting for the next year to come, and it hasn't arrived yet, and for eight years they have been running on the single expansion engine. With the electric drive no such method as that would have been followed. We should have put in the permanent engine and the permanent generator for the part that would have been necessary. Furthermore, by that method you must decide now what kind of goods you are going to manufacture when the increase is made, because you must plan the fly-wheel on your engine, and the proportion of the cylinders for high and low pressure; you must put in your head shafts, it may not pay to change them later, and arrange your mill for something you have definitely in mind. You wait a few years; the market may change entirely, when you come to make your increase the provisions that you have made are entirely inadequate. If you are making fine goods and you expect to make coarse goods, you cannot get power enough. The electric drive will take care of the present, and when the future comes enables you to take care of it just as well as if you had made all the provisions at the time of installing the original plant.

Mr. EDWARD ATKINSON. Mr. President, one of the most interesting installations of electric plant in place of the old

water power plants may be found at Moline and Rock Island, Illinois, where you can see what has happened under the joint supervision of the government and of private owners. Moline happened to be founded by a cousin of mine, who obtained the authority of the government and joint action of the government in establishing the water power. The government has immense works on Rock Island, formerly run by water power. The John Deere Power Works and several other large establishments on the Moline side were owned in my cousin's family. Each had its independent power. Now, the whole power of the dam is converted into electricity, is divided up and is conveyed to each of the several plants, that of the government as well as the private establishments. I give you no details, but if you ever want to see one of the most interesting cities and western manufacturing establishments of the first class, there is the place to see it and to see how the electric plant has taken the place of all the others. I will also mention in connection with what may come, reference has been made to the steam turbine, which is now the accepted power in generating electricity. One of the wisest and most long-foresighted men, conversant with these subjects, said to me the other day that the next step would be the gas turbine.

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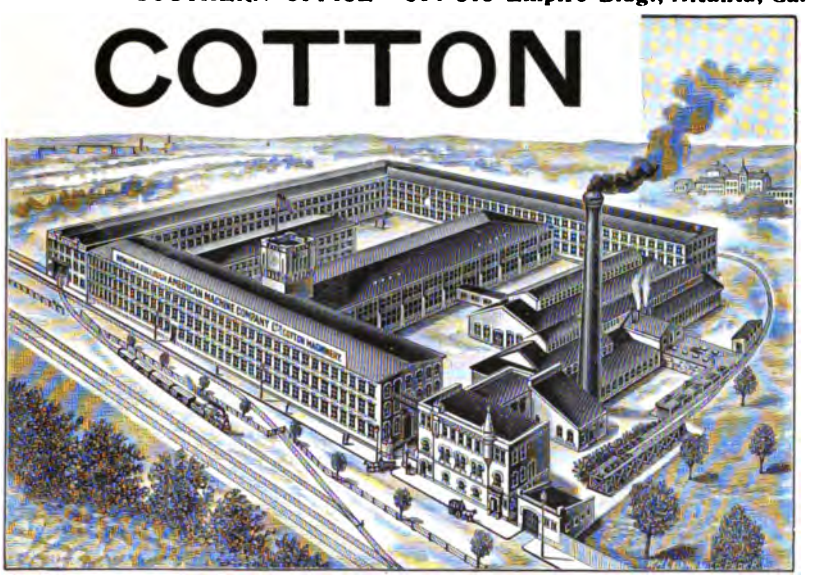

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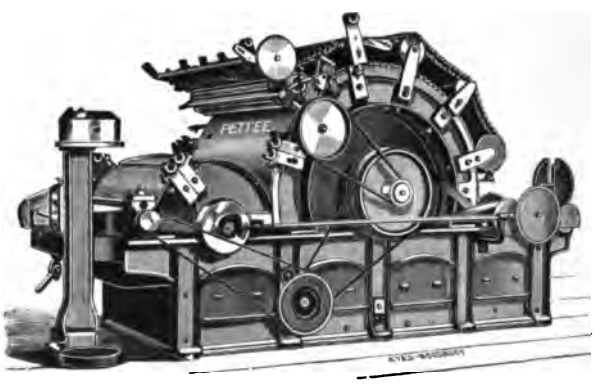

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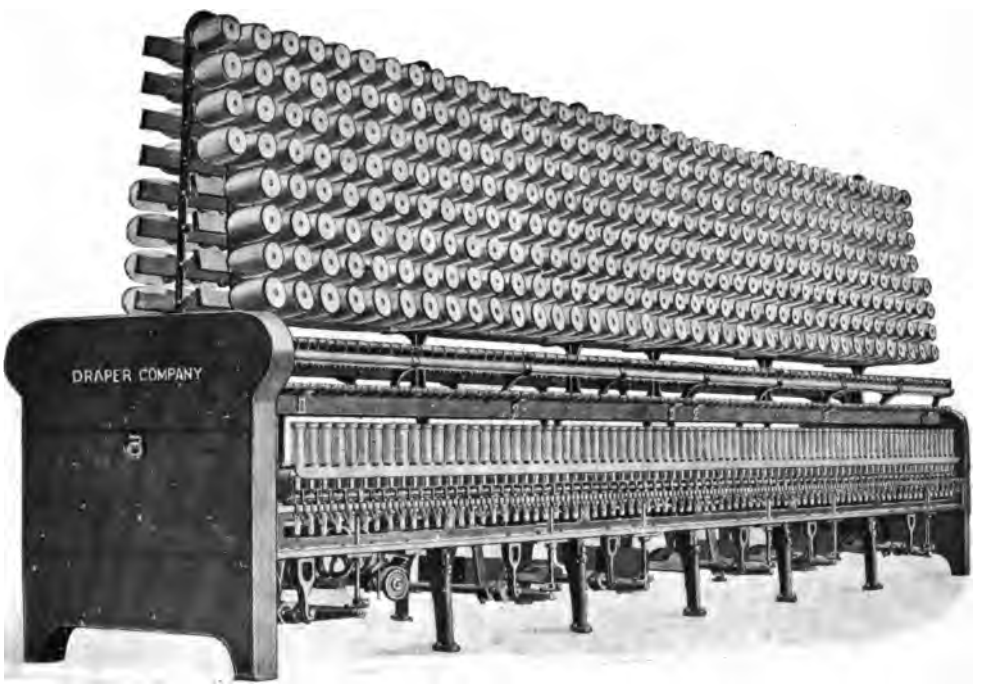

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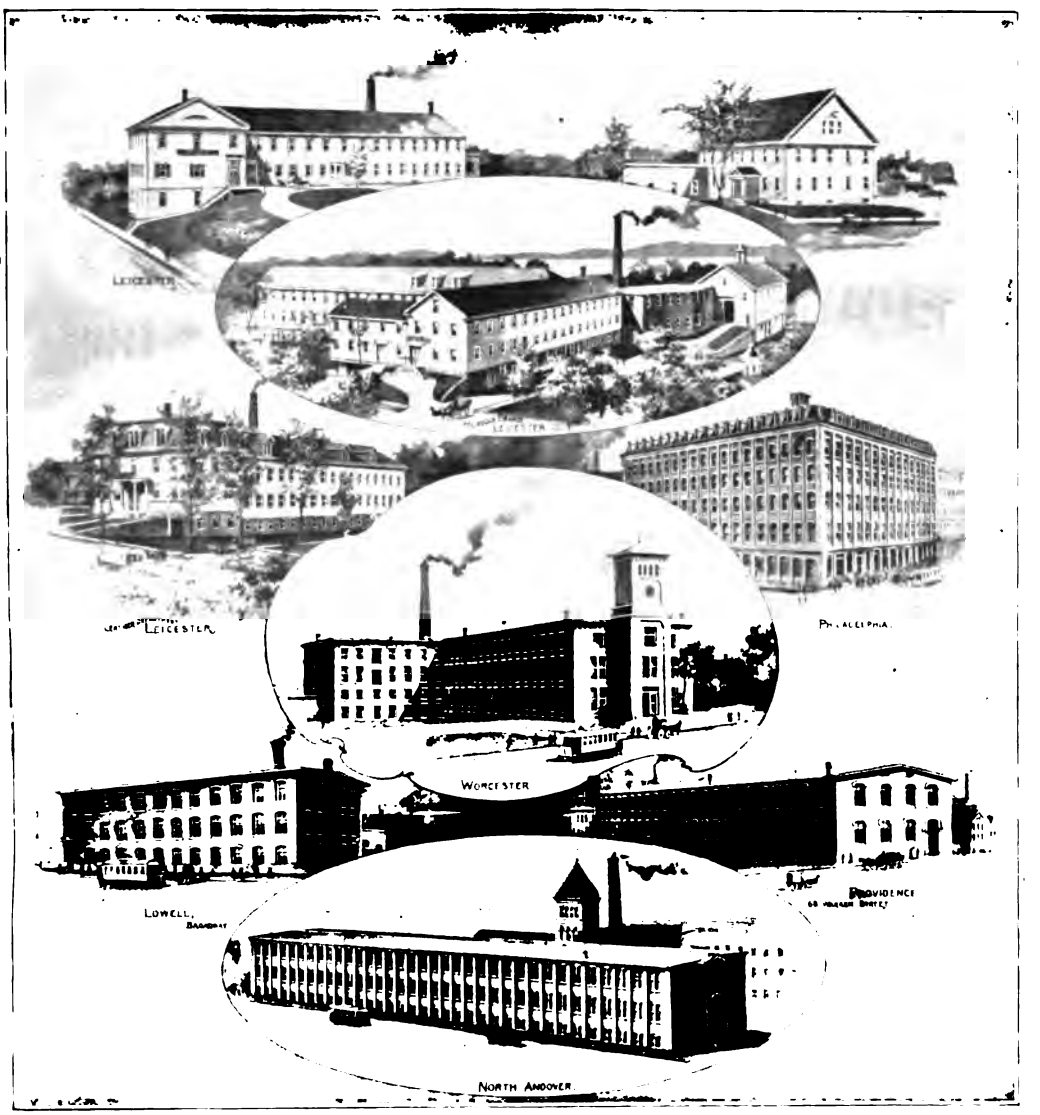

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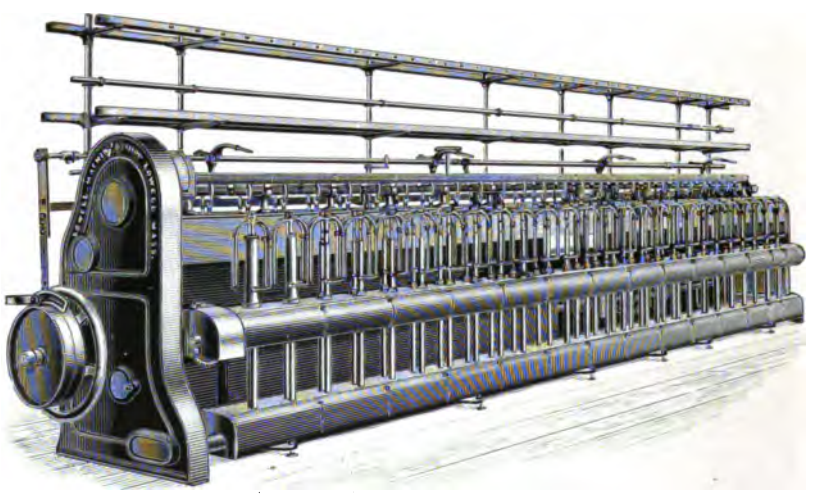

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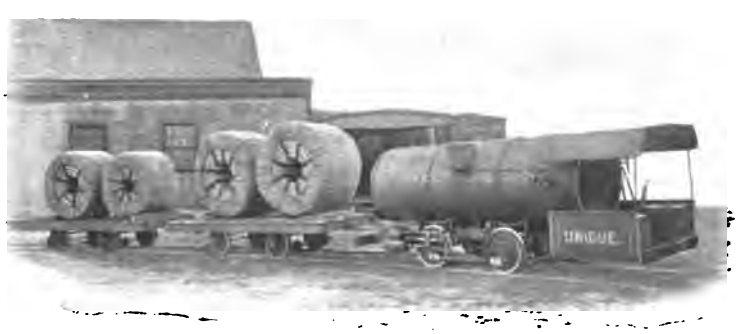

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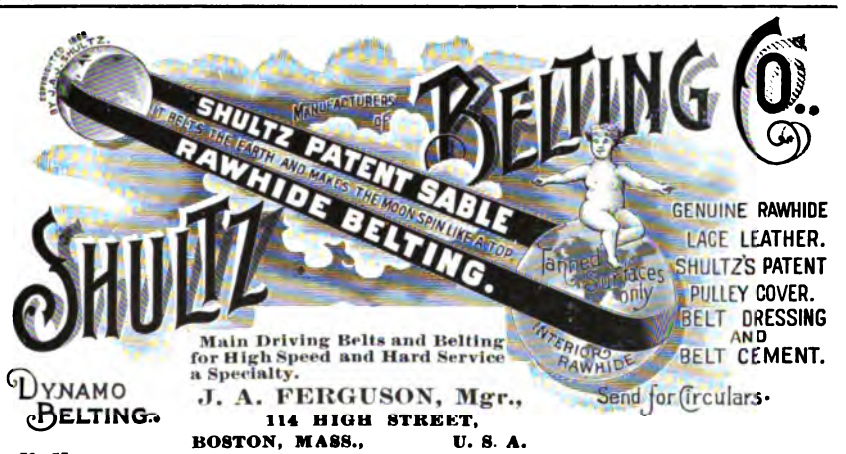
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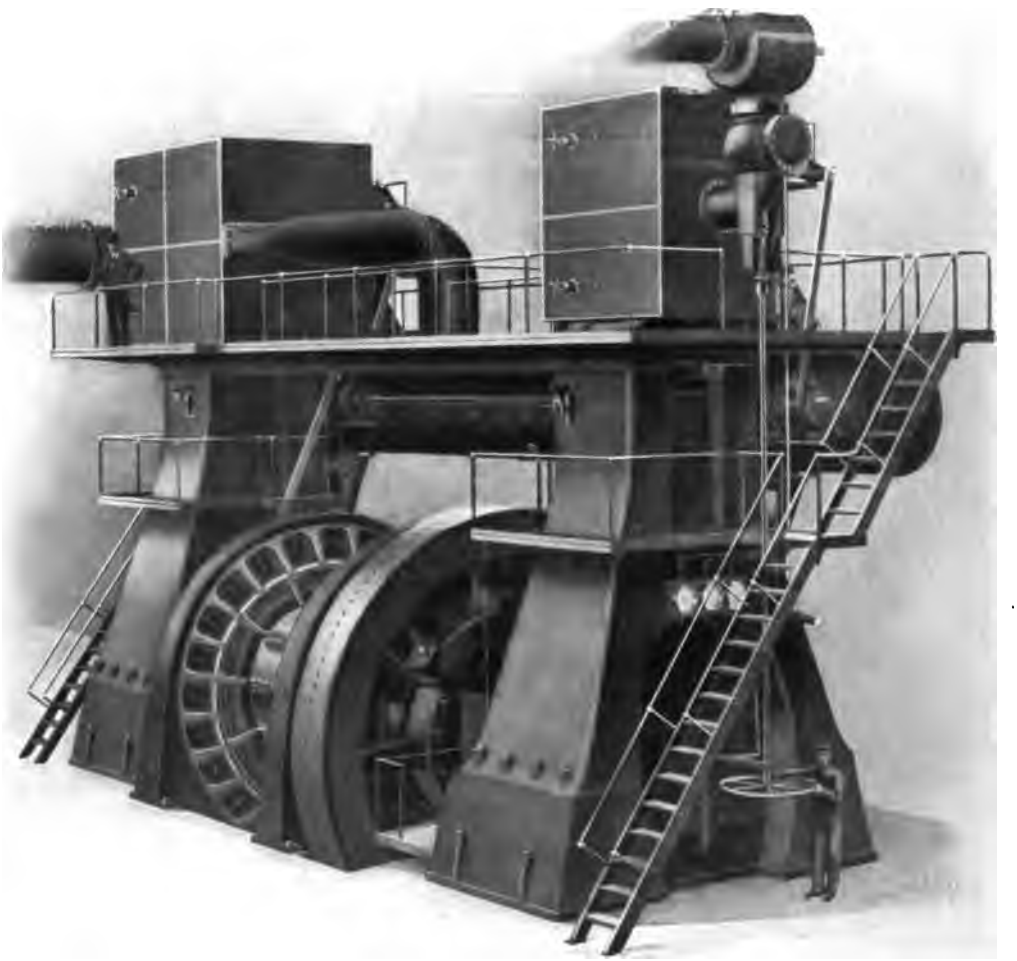

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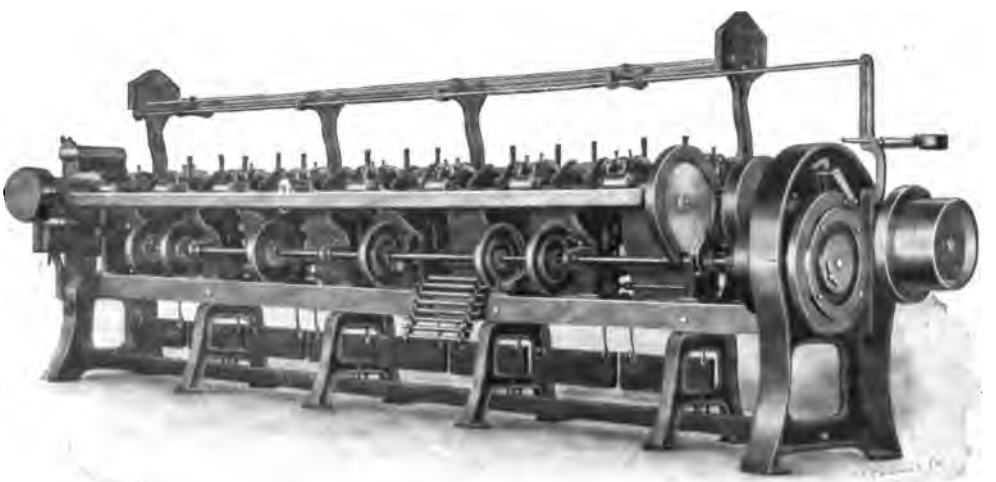

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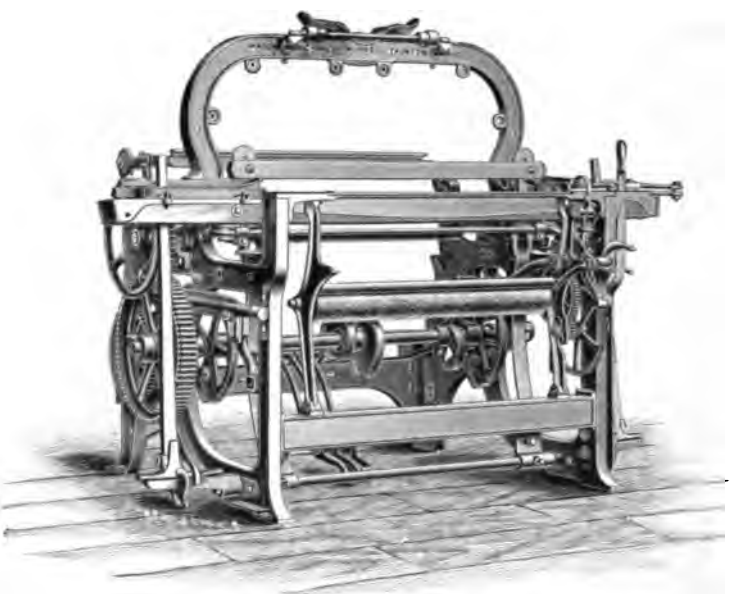

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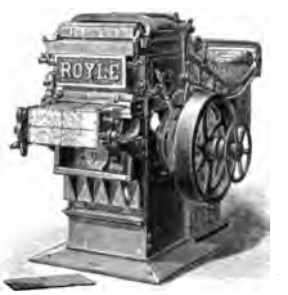

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